Videogames, Informal Teaching, and the Rhetoric of Design

by

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ABSTRACT

This dissertation is about videogames. It is also about teaching, and the ways videogame design represents good teaching. However, this dissertation is not about videogames alone. It makes broad claims about teaching in- and out-of-schools in the 21st Century. Over the last few decades many scholars have been impressed by the rich forms of learning going on out-of-school. In particular, the emergence of digital and social media has fueled interest in *informal learning* while often ignoring or effacing the critical role of teaching. Indeed, the term "informal learning" is common while the term "informal teaching" barely exists. At the same time, the learning sciences have made progress on understanding how learning works based on empirical evidence of how the mind operates. While this research is not well implemented in many of our schools, it is well represented in much out-of-school learning (such as in videogames). This dissertation argues that there is a body of evidence germane to good teaching, that many learning principles celebrated today in out-of-school learning are actually teaching principles, and that good videogames can give us insights into how teaching can work as a form of design with or without games. The dissertation then develops a model of *distributed teaching and learning systems* which involve designed- and emergent organization of various teaching and learning "sites". Finally, the dissertation looks at the rhetorical function of teaching in building a "deliberate learner," one whose goal is not simply to know and do things, but to become a certain type of person committed to new ways with words, forms of interaction, and values. Rhetoric, teaching, learning, and design of all sorts have been set free from institutions and turned loose into a market place of ideas and sites. In the face of this market place we need to engage in discussions about who we

want to be, who we want others to be, and what world we want all of us to live in. These discussions will center not just on “truth”, but on values as well—which is exactly where, in a high-risk imperiled world, they should be centered.

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CHAPTER 1

VIDEOGAMES, INFORMAL TEACHING AND THE RHETORIC OF DESIGN: AN INTRODUCTION

This dissertation is about videogames. It is also about teaching, and the ways videogame design represents good teaching. However, this dissertation is not just about videogames alone. I intend to make fairly broad claims about teaching in and out of schools in the 21st Century. Over the last few decades many scholars have been impressed by the rich forms of learning going on out of school. In particular, the emergence of digital and social media has fueled interest in *informal learning*, especially by groups like the MacArthur Foundation's Digital Media and Learning (DML) initiative and the New Media Consortium. We have celebrated out-of-school learning much more than we have lauded out-of-school teaching. Indeed, the term "informal learning" is common while the term "informal teaching" barely exists. At the same time, the learning sciences have made much progress on understanding how learning works best based on empirical evidence of how the mind operates. While this research is not well implemented in many of our schools, it is well represented in much out of school learning. I will argue that there is a body of evidence germane to good teaching, that many learning principles celebrated today in out-of-school learning are actually teaching principles, and that good videogames can give us deep insights into how teaching can work as a form of design with or without games.

The dissertation goes further than much work on teaching and learning—often associated only with Schools of Education—to argue that teaching is a rhetorical act and, indeed, one of the most important rhetorical acts we undertake in civil society and in our

schools and institutions. Teachers must persuade learners to take on new identities, otherwise the motivation necessary for learning—the necessity that learners must choose to learn—may not be present. Learners must be persuaded not just to know, but to *be a kind of person* who wants to enter the human discourses and engage with problems that center around things like science, the arts, media, mathematics, politics, citizenship, the maker movement, and the environment. These are the problems that create the social geography of professions, interests and passions, and institutions in our society. Even more importantly, learners must be persuaded to become *deliberate learners*, people who know how to direct their own learning, manage their own deliberate practice, and become their own teachers. No one starts as a deliberate learner; they require teachers, though not necessarily people who carry that title in any formal way.

The relationship between digital media and teaching, however, is an underrepresented topic in the literature on informal learning, which predominantly focuses on the *learning* that happens through digital media but often leaves *teaching* unaccounted for or only implicitly relevant. This is especially true in the field of games-based learning (GBL) and in many GBL interventions. Early claims about what games can do have often been plagued by a rush to simply use games without considering how they work best, where they need support, and their interdependence on other forms of teaching. At a time when federal and local governing entities, corporations and non-profits, and even individual teachers have increasingly proposed and actively introduced videogames and other digital media as a remedy to the troubled state of public education, ignoring teaching is a dangerous miscalculation of what makes for effective learning, and a misguided application of the potential of videogames. At best, this points to the misuse

of a significant amount of money and time on the part of regulators, administrators, media makers, and teachers. At worst, it perpetuates flawed and even damaging models of instruction that downplay the critical role of active teaching.

Ignoring or downplaying teaching creates two critical problems. The first is that by leaving teaching out of the learning process, we treat learning as something that "just happens." This obscures the *act* of teaching, and the way teaching shapes not only the learning event but the learner themselves as they move across a range of learning (and teaching) encounters. The second problem is that minimizing the role of teaching ignores or even contradicts strong empirical evidence which emphasizes the essential role of teaching in promoting deep and effective learning. Indeed, we have invested significant resources into developing a "learning science," but have more or less completely ignored any kind of "teaching science."

I will argue here that it is indeed possible to conceive of a science of teaching which honors this evidence. The term "teaching," of course, is used in a variety of ways in both everyday use and in academic discourse. There are a great number of definitions for teaching, and often they are conflicting or contradictory. I will not analyze them here, and this dissertation is not an attempt to critique any one definition of teaching in particular. It is also not an attempt to apply an existing theory of teaching to games. Instead, I will develop my own theory of teaching that applies to games, but also to any act of teaching in any kind of context.

I define "teaching" as a *communicative act designed to inform* (by which I mean "inform" in the most literal sense—to "form" someone's thinking in a particular way). This definition stresses the dynamic, context-rich, active process of teaching. Teaching is

a form of persuasion (*communicative*); it involves action and actors (*act*); it is created and modified by these various actors (*designed*) and changes the actors towards some particular, preferred way of viewing and acting in the world (*inform*). This definition does not distinguish whether these things are done in games, in out of school learning, or in school. Instead, I use this definition to explore *how* they are done, that is, whether they reflect empirically grounded claims about how to do them well or effectively.

I believe that "good" videogame design demonstrates this definition particularly well, and that "good" videogames also align with the evidence for "good" teaching. This dissertation explicitly shows how videogames teach, tied to a set of principles derived from Hattie's (2009, 2012; Hattie and Yates, 2014) remarkable meta-meta-analyses on empirically based claims about effective teaching. Much like Gee (2003) showed how games align to a theory of learning based on evidence from the cognitive sciences, I believe the same can be done for games and teaching. Further, I believe the *ways* games teach can tell us a great deal about other kinds of teaching regardless of where that teaching takes place.

This dissertation will engage in analysis of videogames to test whether and how elements of such games reflect empirically grounded principles of learning and teaching. The analysis of games is built on theories about how games are designed and what their parts are, much as an analysis of language can be based on a theory of grammar. The design theories I use are based on a large body of work in game studies and game design (for example, game design books by Fullerton, 2008; Schell, 2008; Salen and Zimmerman, 2003; and Koster, 2004 provide a great deal of the terminology and design insight I will use throughout this dissertation).

Emphasizing game design features allows for two forms of analysis. First, I will "reverse engineer" different videogames to show how games teach, and in particular how they leverage empirically grounded principles of good teaching based on Hattie's work. I will argue that games represent a form of *teaching by design*. Second, I will then show how design thinking is a foundation for teaching practice. I will argue that all teaching, whether done by a game or a person, is a design science and that teachers are designers who design *learning systems*. These two forms of analysis are complimentary; one looks at places where teaching happens to consider *how it happens*, while the other is a way of looking at building teaching and learning activities to consider *how it might happen*.

Work on aligning aspects of game design (the grammar of games) to empirically grounded learning principles has already been carried out by a number of people, starting with Gee's (2003) *What Video Games Have to Teach Us About Learning and Literacy* and followed by more than a decade's worth of GBL literature and implementations. I do not seek to re-do this work, but only to supplement it and make some corrections to it. One of the biggest corrections I aim to make is to clarify the role of teaching in digital media and learning. As I've argued above (and will do so more fully in Chapter 2), the trend to downplay teachers and teaching is caused in part by the fact that so much work on digital media and learning has focused on out-of-school learning and celebrated the creativity and learning of young people engaged with today's ever more sophisticated popular culture. Indeed, even Gee's acclaimed work tends to confuse learning and teaching principles and in the act effaces the role of instruction and teaching. Yet even here, in out-of-school learning in homes and on interest-driven Internet sites, I will argue

a good deal of teaching and instruction goes on and is essential to deeper understanding of learning regardless of its form or location.

This dissertation will develop a theory of teaching fit for a world where teaching and learning go in both inside and outside of school and are often enhanced by digital media and other technologies. I will define a set of teaching acts which make up the foundation for teaching regardless where it takes place. I will also show how teaching happens in a game, apart from any formal institution. From there, I will argue that informal teaching actually happens across a range of sites, and that it is possible to think of teaching as a distributed, networked activity.

The dissertation will also offer a novel theory of the role of rhetoric in the area of games and learning, and, indeed, in the area of teaching and learning more generally. A good deal of work in psychology and linguistics has argued that identity is at the heart of learning. The goal of teaching is ultimately to produce what I have called "a deliberate learner". A deliberate learner is someone who takes on the role as their own teacher and orchestrates their own learning, throughout life, in terms of the very empirically grounded principles of teaching and learning this dissertation is about. The role requires, according to research on teaching and learning, dispositions and ways of talking and acting that constitute an identity, a way of being in the world, a certain "form of life". Good teaching, the dissertation will argue, is like a conversation between teacher and student in which the teacher is, through rhetoric, seeking to persuade the student to become a deliberate learner as a certain type of socioculturally-significant identity. The dissertation will show how many of the principles about learning and teaching that have been developed in the learning sciences can be reinterpreted as rhetorical principles, not just in

terms of language, but in terms of language and action and, indeed, language as action itself. Teaching can be seen as a form of "self-fashioning" where the teacher fashions the learner as a certain sort of self that will eventually engage in his or her own self-fashioning using an identity as a deliberate learner to fashion new roles and identities throughout their lives.

Teaching in Videogames and Beyond

What do we gain from thinking about the nature of teaching in videogames? In the narrowest sense, we gain a deeper appreciation of videogames and game design. We can build more robust models of games, both as *designed artifacts* and in the use of games as *activities*. It provides a framework and vocabulary for recognizing and describing how videogames teach. It may lead to designing formal or informal teaching interventions that leverage the good teaching demonstrated by videogames. It may also lead to designs for games which consciously adopt these principles to create deep and purposeful opportunities for teaching and learning.

There are broader implications beyond videogames. Recognizing that videogames *do* teach can illuminate how teaching occurs in all kinds of spaces, both formal (schools) and informal (videogames, certainly, but also social media sites, workplaces, even parent-and-child interactions). A much broader range of activities can be included as instances of teaching. This means that all the various places that teaching already occurs in the everyday world, especially those places that are *not* school, can be recognized as teaching domains. Again, this might lead to better analysis of these informal interactions and to designing new and modifying existing teaching and learning spaces.

Defining the act of teaching as a design process establishes some rigor to the practice and demystifies the "art" of teaching in important ways. Good teaching—like good videogame design—certainly is a kind of art; there is no simple formula that works in all cases or all contexts. Thinking of teaching as a kind of design, however, allows us to consider teachers as *creators* of learning events who make choices about the ways they teach, what kinds of problems they address, and how they execute them. It reinforces the continuing move away from the fundamentally flawed (yet still alarmingly prevalent) transmission model of teaching towards a view of teaching as actively and purposefully shaping learning encounters. It also allows more academic disciplines to address issues of teaching beyond the traditional field of education, including those in computer science, communications, rhetoric, design theory, and more. No one discipline or school of thought "owns" the issue of teaching, and reframing teaching as a form of design invites new perspectives that have traditionally been ignored.

Finally, I believe that expanding the spaces where teaching occurs and the actors who teach will emphasize teaching in an era where claims about learning suggest that it is ubiquitous but which simultaneously ignore or underdevelop the role of teaching in those same places. I hope to reprofessionalize "formal" (school) teachers by giving them a legitimate, evidence-based role in the classroom. At the same time, I seek to extend the role of teacher into a variety of other actors and tools traditionally unaccounted for. This theory suggests that parents, peers, designers, and others have a role in teaching and have the means to do so successfully, regardless of any "institutional" backing.

Note on Methods, Data, and Terms

This dissertation is intended to do two major things. First, to summarize some key claims about the growing digital media and learning movement, particularly claims about videogames, and to point out places where teaching has been underdeveloped or ignored in order to put teaching back into the equation. Second, to develop a theory about teaching wherever it occurs—in formal or informal environments—and look at examples from videogames, supported both by my own play and the large body of literature around gaming, in order to look for opportunities to develop, critique, and rectify teaching in a world in which learning is not bound to any single institution (school) but is indeed ubiquitous.

To accomplish these goals, this dissertation uses a variety of examples culled from my own gameplay. I have engaged as a participant in a broad range of gaming practices for more than 30 years, and have actively researched gaming through a number of theoretical lenses for more than 10 years. Furthermore, much of my gameplay experience is both replicable (anyone who picks up most of the games I will use in this dissertation will encounter the same design features and will have similar—though not identical—gameplay experiences) and is supported by the gaming literature, including, for example, the work of Gee (2003, 2007), Jenkins (2006a), Squire (2006, 2011), Steinkuehler (2007, 2008), Waggoner (2009), Stevens, Satwicz, and McCarthy (2008), Hayes and Duncan (2010), Gee and Hayes (2010), and many, many others. I have identified much of this theoretical framework in Chapter 2 as both sources of support in the claims I make about games and learning as well as opportunities to critique these works, especially when it comes to discussions of teaching.

This dissertation is based on a particular approach to interpretive research (an area that includes things like rhetoric, literary criticism, and paleobiology, as Gould [1990] famously argued in his book *Wonderful Life: The Burgess Shale and the Nature of History*). It is also based on design research (an area that includes work on design of things like media as well as work in education and the Learning Sciences; see, for example, Cross, 2007; Schön, 1983, 1987; Collins, Joseph, and Bielaczyc, 2004; Edelson, 2002; Norman, 1990). I am also inspired by—and adopt—theories of game design articulated by authors such as Fullerton (2008), Salen and Zimmerman (2003), Schell (2008), Koster (2004), Costykian (2002), and others who more fully address the unique practices of making and playing interactive videogames.

More directly, this dissertation engages in a mixed methodological approach to analyzing games and teaching. My own role as an ethnographic participant is central and my own experience playing various games forms the basis of the evidence I gather; this approach is similar to Sudnow's (2001) *Ways of the Hand*. But this method of culling examples from my own play is supplemented by design research methodology (see especially Cross, 2007) by looking at the decisions made during the design of various games to illuminate the underlying philosophy or purpose of the designed feature. Again, this type of research necessitates a certain level of interpretation, phenomenological exploration, and an epistemological bent towards "understanding" rather than "predicting," "emancipating," or "deconstructing" (Lather, 2006).

From there, I will tie these examples back to a theory of teaching derived from John Hattie's (2014) meta-meta-analysis of empirically based claims about effective teaching and from empirically grounded claims about deep and effective learning from a

situated/embodied approach to cognition. This dissertation seeks to find out the extent to which good videogames reflect empirically grounded claims about learning and teaching that stem from these two bodies of research. To put as fine a point on it as I can, the method I will use for this dissertation is this: I will use two sources of research (Hattie's Visible Learning work and situated/embodied cognition) to develop a theory of teaching; I will then look for examples of videogames which use some form of teaching; I will then look to see if these examples fit the theory I have developed. Like all interpretive research, the validity of my evidence and my claims is whether they plausibly align with the theory or not.

Furthermore, this dissertation is an attempt not just to develop a theory of teaching, nor to simply provide a deep reading of some videogame, but to argue that this theory can also generate further research. I have already made the claim that much of the digital media and learning literature effaces the role of teaching (a claim I develop more fully in Chapter 2) I also have suggested that many conceptualizations of teaching are tied closely with the formal institution of school. One obvious step, given these claims, is to look at teaching out of school where so many other claims about learning have been made and try to uncover and emphasize the critical role of teaching wherever it happens. I have also made the argument that videogames model good teaching, and that they might be able to inspire teaching intervention designs which leverage what they seem to do so well.

Data. Because I believe that many different games demonstrate teaching, and that the theory of teaching I will develop aligns so well to many different games, I will

include a variety of examples drawn from many different games. I have based these selections on many thousands of hours of game play experience across hundreds of games; these examples are ones I have found, in my experience, to be particularly illuminating or readily apparent in the way they demonstrate the feature at hand. My intent is to suggest that examples can be found all over, and that good teaching is in no way limited to a single game or even a small set of games; many, many games demonstrate good teaching, in part because of their nature as games (as I will discuss in Chapter 3 more fully). Also, because space is limited in a dissertation such as this, I can only point out a few brief examples here. I have set up a website, www.distributedteaching.com, where I have collected many other examples and leveraged the affordances of hypertext and digital media to include videos, links between games and features, and more that are simply impossible in a text-based document. I encourage all readers to spend time on this website where they will, hopefully, gain an even fuller appreciation of the varied and numerous examples.

I have also identified one game in particular that calls for a closer analysis, the game *Dota 2*. I have selected this game for several reasons. First, it contains nearly all of the teaching principles I develop and demonstrates them in action across many different features of the game; it is a rich source of examples. Second, *Dota 2* is also a very well designed and executed game and many of the teaching acts are, simply put, good; the game is a good teacher. Lastly, *Dota 2* contains several features which help support the claim I will make about designing and enacting networked and distributed teaching, including various built-in social features and player-driven content; it is a "forward-looking" game as far as teaching goes. Indeed, I devote all of Chapters 5 and 6 to *Dota 2*

primarily because it is, in my experience, a phenomenal model of what distributed, digitally-enabled, informal teaching and learning looks like.

Lastly, I must also emphasize that most of my data arises through my own gameplay experience but that actual demonstrations of this data is captured in this dissertation by imperfect means by necessity; while the various forms I uses such as screenshots, video links, or narrative description are, by their nature as part of a linear, text-driven dissertation, the only way I have to share these experiences, these are hardly adequate to capture the experience of *actually* playing the games themselves. I highly recommend that all readers spend some time playing games (hopefully some of the same ones I have used as examples) to look for points which validate or contradict the claims I will make here; at the very least, I strongly encourage readers to play *Dota 2* to experience even a taste of the complex and highly polished game-system in order to get a better sense of how the many teaching acts I will describe fit together as a seamless part of the overall gameplay experience. The game is free-to-play and installs easily through Valve's Steam client.

Terms. This dissertation tackles big issues. Videogames—despite being a relatively new field of serious academic study—have generated a tremendous breadth of discussion, ranging from issues of rules and mechanics to stories and player narratives to gender and representation to educational and commercial applications and a great deal more. Teaching, of course, is one of the oldest fields of study with thousands of years of tradition (and the accompanying diversity of approaches and topics); in the Western canon, teaching has been discussed by the ancient Greeks including Plato, Aristotle, and

Isocrates (Cahn, 1989), by the ancient Romans including Quintilian, Cicero, Apuleius and others (Maurice, 2013), during the Renaissance and Enlightenment eras by Locke, Hegel, Rousseau, and Kant (Kennedy, 1999), and the modern era by figures such as Dewey, Heideggar, Noddings, Apple, Friere, Piaget, Vygotsky and many others. These discussions have covered a range of philosophical and practical grounds, from the nature and role of education to various techniques and methods for teaching. There have been vehement debates, for instance, about essentialism and pragmatism, perennialism and progressivism, idealism and realism, critical theory and existentialism, democratic education and liberal education, and many others. Covering all of this territory is impossible, and this dissertation does not aim to. Instead, I wish to explore the issue of teaching on terms that I personally find useful and necessary. However, I do cede that these discussions—spanning more than two thousand years—have at least some sway over my own theories which I develop in this dissertation. It is necessary, then, to make a few general claims about several key issues that are crucial to understanding this analysis but which remain beyond its overall scope.

I will also use a number of terms or phrases which often have many different (often conflicting) definitions depending on the various discipline, sub-discipline, genre, theory, or time period in which they are variously used. So, for clarity's sake, I want to define a few of the important—but potentially problematic—terms in order to state, as best as I can, what I will mean by these terms. This is not to discount various other usages (although I may not agree with those) nor is it to engage in any critique of them, overt or otherwise (unless I feel the need to critique that term specifically, in which I will provide some justification for doing so). My aim in doing so is simple: to avoid as many semantic

disputes as possible, and to be as direct as I am able, I will say what I believe a term means or to what a term refers. If, at any point, these terms bump up against some other definition used elsewhere, I will rely on the charity and indulgence of the reader to accept, within the frame of this dissertation, the ways in which I have defined the term.

The science of teaching. Above I used the phrase "the science of teaching." Indeed, I believe that Hattie's research in particular suggests that it is fundamentally possible to develop a "science" of teaching just as we've developed a "science" of learning. Let me be very clear in how I am using the term "science" and the phrase "science of teaching." There is certainly a centuries-old—and often still on-going—debate about the nature of, and the relationship between, the science of teaching and the art of teaching, not the least of which are various debates over *episteme* and *techne* in the rhetorical tradition extending back before Plato (see Parry, 2014). A great deal of (often) tacit knowledge is developed through practice and the "craft" of teaching is unquestionably important; teaching is, ultimately, about *doing* and is a practical act. Claims about the "science of teaching" are often viewed as a threat to the craft or practice of teaching. Many contemporary views of teaching often seek to stress a middle ground of sorts, a recognition that there is a need for both a practice and a theory of practice around teaching; even groups like the Bill & Melinda Gates Foundation have stressed the "art and science of teaching" (Gates, 2013).

I do not wish to rehash these arguments, in part because I believe many mischaracterize the nature of "art" and "science." Particularly in America, science is often associated solely with "hard sciences" with controlled studies and clinical laboratory conditions (Gee, 2013). In many "messy" subjects, like literature or the any of the various humanities, these conditions will never exist and therefore, so this view holds, "science" cannot exist (Moretti, 2013). However, across much of Europe these messy subjects are indeed treated as scientific pursuits in part because Europeans (generally speaking) have a different view of science (see, for example, literary theory by Bourdieu, 1991; Schmidt, 2010). This view of science, in the most general sense, is defined broadly as *the collaborative accumulation of empirically-derived evidence*. Science relies on the alignment of theory and evidence.

It is in this second sense that I will use the term "science". This is not the only meaning of science, for sure, since science is also a practice (Gee, 2010, Latour, 1999). However, here I wish to us the phrase "the science of teaching" to mean that it is possible to gather evidence (which has been demonstrated and could likely be repeated given similar circumstances) about what is effective in teaching that promotes deep learning to build a theory of teaching. This theory then drives the "lived" practice—based on evidence—of teaching.

Good games. There are many thousands of videogames. Some are commercial, "AAA" entertainment titles like *World of Warcraft* or *Call of Duty*. Some are small, "indie" games, either commercial (such as *Braid* or *Super Meat Boy*) or not

(such as *Dys4ia* or *Mainichi*). Some are designed explicitly for the classroom, like *Quest Atlantis* or *Argubots: Mars Generation One*. Some are designed as educational games not tied to any specific institution, such as *Brain Age* or *Gamestar Mechanic*. Some games are co-opted for school though they may have never intended to be there, like *MinecraftEdu* or *Kerbal Space Program*. There are some that overlap many of these distinctions.

In short, there are lots of different kinds of games, and they cover so much ground stylistically and systemically that there may not be a single, satisfactory definition of "videogame." At best, they might all share some features with each other, though not all features (what Gee, 2004, calls "family resemblances," referring to Wittgenstein's linguistic term). Videogames are used for different purposes, by different people, for different reasons. What I am getting at is that it is no use talking about games unless it's clear what purpose I have in mind, and in what ways I am referring to videogames.

Throughout this dissertation, I will use the terms "videogame" and "good videogame." These are not entirely interchangeable, and I will try to be clear when using them in regards to two important things: a) that the terms "videogame" and "videogames" are meant to be a blanket phrase while not necessarily meaning that all videogames work in that particular instance, and b) that not all games are "good". By "good videogame," I will broadly mean games that demonstrate the teaching acts and use the principles derived from Hattie's work which I define in Chapter 4. That is, "good games" are ones which honor the principles of good teaching. Not all games are "good," and some games are

"good" in some cases but not in others. "Good game" will not necessarily refer to the *quality* of a game but in terms of its alignment to good teaching.

I also want to draw a distinction between the idea that games are good teachers and that games *model* good teaching in action, with a particular focus on the latter. My emphasis is not that games are good teachers (they can be, with the right support and in the right environment) but that games provide a model of what good teaching looks like. While I will often emphasize the way that a game teaches, I do not, as a rule, advocate simply replacing a teacher (especially a classroom teacher in a contemporary school setting) with a game. Few, if any, current games are good at teaching in that way, and certainly not just as "plug-and-play" teaching tools. However, I am advocating for conscious game design practices which might lead to better alignment with all kinds of teaching (in school and out). And I am certainly advocating for rethinking how school operates to leverage the models of teaching that good videogames demonstrate.

Learning. This dissertation takes as its basis theories about empirically grounded claims of deep and effective learning from a situated/embodied approach to cognition (see especially Brown, Collins, and Duguid, 1989; Lave and Wenger, 1991; Kirschner and Whitson, 1997; Clark, 1997, 2003; Gee, 2004; Glenberg, 2010). This thesis does not offer further evidence for these theories directly, but rather tests how these theories apply to videogames, especially in light of Hattie's meta-meta-analyses. The thesis seeks to find out the extent to which good

videogames reflect empirically grounded claims about learning and teaching that stem from these theories about learning.

I also make a distinction about what kinds of things people learn from games. Videogames, as both complex systems and interactive designs, often allow for a great array of possible ways to play them. Indeed, the economic reality for many games—especially large commercial games—is that the game needs to be approachable to novices and experts, "aficionados" and "casuals" alike. These games are designed to cater to different levels of engagement, though this certainly varies from title to title. Further, games can be designed to "promote" some behavior over others, though players are often very creative when it comes to "emergent" play.

Some players, for example, will play a game like *Grand Theft Auto V* and learn about how to strategically engage with the game environment and develop theories (supported by cues in the game) about how best to act. Others might play the same game to mindlessly cause mayhem, and they may even get good at it. These players learned very different things, even different levels of thinking. I am concerned chiefly with the former case, where the player—supported by the game—reflectively plays the game, actively seeking out ways to master the complexity of the game and their own performance. More importantly, I am interested in looking at the ways the game goes about promoting some learning though its design, and how these design features can be thought of as teaching.

Learning and teaching. Even more directly, I wish to de-couple the act of teaching from the problematic relationship with school. I make a distinction here between the conditions for uptake and actual uptake (learning). This is in part a practical move, as I am not interested in specific instances of whether a learner learns some thing but rather to theorize what causes uptake in the first place and how that can be shaped through teaching. I also want to stress that teaching does not *make* learning happen. The learner has some role in the transaction, and a teaching event can lead to successful uptake in some learner and not another. Part of what makes something not just "teaching" but "good teaching" (as described in Chapter 4) is that it is a self-reflective practice and a teacher can recognize (through the act of *assessment*) when uptake doesn't occur and can modify their teaching to promote learning in a different way.

Another key move in defining a teaching event as some combination of teaching acts is that it allows for a broad range of activities to be considered as teaching that may be excluded in the everyday definition of the word. In colloquial use (and even much scholarly use) teaching is often bound up with lessons and tests and many of the other trappings of school or other "formal" institutions (like a museum). Teaching, in this use, is often administered by a professional expert, one whose "job" is that of "teacher" (or instructor, tutor, coach). This concept of teaching ignores that a slightly more knowledgeable peer can teach (say, a child's friend who knows more about *Pokémon* who shows strategies for using various cards in the deck). It certainly cannot account for the notion that *organizing* how someone encounters *other teaching events* is itself a

kind of teaching (a parent who schedules piano lessons for their child provides some motivation to the child and can position the way the child values that kind of identity, action, or experience). Indeed, as I'll argue more fully in Chapter 6, it's possible to conceive of teaching as a distributed network of different encounters with tools, people, and environments – and these teaching events are the frame which can help connect them.

Dissertation Outline

Chapter 2: Informal Learning, Digital Media, Videogames, and the Role of Informal Teaching

Despite a growing body of literature around informal learning over the last 40 years, the term itself is unsettled. Sefton-Green (2004) argues that informal learning literature can refer to "what" is learned, "how" it is learned, "where" it is learned and more. More recently, research into digital media and learning (especially though the MacArthur Foundation's Digital Media and Learning network) and game-based learning have further compounded the issues around informal learning. This chapter looks at the various claims about informal learning, from the nature of informal learning, to the assumptions about digital and game-based learning, with a particular emphasis on the lack of talk about teaching. I will make the claim that informal learning claims are based on strong foundations of situated and embodied learning but underplay the role of teaching. I will argue that this is the result, at least in part, of a misconception about "teaching" as a professional act, and that many theories of informal learning actively oppose the nature of "formal" teaching from ideological

standpoints. It is against these points of view that this dissertation is primarily aimed. I will make the case throughout the subsequent chapters that there is empirical evidence for the role of teaching and that teaching extends far beyond traditional "classroom" models of teaching.

Chapter 3: Videogames and Teaching as Design

This chapter is dedicated to describing teaching as a *kind of design* which creates opportunities for deep learning to occur, learning which aligns to theories of experiential, associative, and social cognition. I will highlight important conditions which lead to good learning experiences, and look for ways in which game designers (as teachers) can design to maximize these features. Finally, I briefly examine the design rationale described by Warren Spector for the game *Deus Ex* to see how it does (and does not) align with features of good teaching and learning experiences.

Chapter 4: Videogames, Teaching Acts, and Good Teaching

This chapter develops the central theory about the *act* of teaching that I will use throughout the rest of the dissertation, and how this teaching manifests in games. I begin by operationalizing teaching. I define a set of *teaching acts* (showing, telling, assessment, design, and motivation). I argue that anywhere some combination of these acts occurs, it "counts" as a teaching event. I then outline a set of 11 *good teaching principles* based on Hattie's work on Visible Learning, from managing the learner's "attentional economy" to building learning identities. Throughout, I look at ways games use teaching acts and how they honor these good teaching principles.

Chapter 5: Videogames and Informal Teaching

Using the commercial game *Dota 2*, I use the theory of teaching I develop in the previous chapter to show how the game "teaches." In particular, the game uses explicit examples of each of the five teaching acts: it shows and tells the player how to act successfully, it assesses the player's performance and provides meaningful feedback, it motivates the player through narrative and mechanical features, and it is designed to deliver these teaching acts in an effective and meaningful way. Further, the game leverages the good design principles derived from Hattie's work in insightful ways. In the end, I argue that *Dota 2* is a teacher, and that teaching exists outside of the classroom in informal spaces where teaching is rarely talked about.

Chapter 6: Distributed Teaching and Learning Systems in **Dota 2**

The teaching in *Dota 2* is not confined solely to the "code" of the game, but extends across a range of "informal teaching" platforms both within the game system and outside of it. As Gee (2003) and Jenkins (2006b) argue, games are part of a growing "media ecology" that includes things like YouTube walkthroughs and tutorials, guides and FAQs, web forums, "theorycrafting," cosplay and a host of other activities. Typically we have celebrated these spaces as learning sites; this chapter argues that we should also consider these teaching sites. *Dota 2* represents a kind of teaching which creates *conditions* for teaching but leverages user participation to create the actual teaching event as a kind of reciprocal emergent event. I argue further that these sites—within the game and beyond—represent a "bottom up" network of

teaching events that players can customize to meet their own goals, and that teaching is not a set of isolated activities but the result of a trajectory across a range of different teaching encounters.

Chapter 7: Teaching as a Rhetorical Act

In this chapter, I argue that the "goal" of teaching is not just to transmit some fact but to create the identity of "deliberate learner," where a person reflects on and consciously directs their own learning. Thinking itself is a resources intensive process, and we are wired to avoid thinking as much as possible (Willingham, 2010). We must, at a fundamental level, be convinced that thinking is worth doing, and the act of learning will "pay off." In many ways this model of the mind goes against the common notion that we are born to learn; instead, we often learn only by convincing ourselves that it is worth it and that learning aligns to some goal. The role of teaching, then, is to help fashion a person (an identity) who believes that learning is a worthwhile pursuit, and teaching gives those tools to use. In this way, teaching is a rhetorical, communicative act geared towards building this identity. I show how games use design features such as narrative and player agency to help fashion reflective learners, and how teaching more broadly can be seen as a design practice to serve the same purpose.

CHAPTER 2

INFORMAL LEARNING, DIGITAL MEDIA, VIDEOGAMES, AND THE ROLE OF INFORMAL TEACHING

By many different metrics, contemporary American public schools are in crisis (Gee, 2013). At the same time, educators and parents alike have noticed an engagement with out-of-school activities, particularly with digital media, that kids lack when it comes to school (Ito et al. 2013). Many of these activities include all kinds of learning—language learning, content learning, social learning, and more—that schools simply do not capture. The digital media and learning movement has adopted a great deal from informal learning research, particularly by contrasting it with school-based education and setting up digital media as a method of school reform.

As interest in digital media and learning has increased, scholars, policy makers, and game designers have turned to videogames as one particularly insightful field for the study of good learning and for reconfiguring formal educational settings. Groups like the MacArthur Foundation's Digital Media and Learning (DML) and the New Media Consortium (Johnson et al., 2014) initiative have consistently highlighted the significance—and increasing use—of game-based learning in- and out of the classroom. At the same time, the commercial, off-the-shelf (COTS) game market has grown significantly, now accounting for over $20 billion in annual revenue (Electronic Software Association, 2013), more than doubling since 2004. Games specifically designed for education have grown similarly (although accounting for only a small portion of that overall revenue).

Gee's (2003) work was a seminal part of legitimizing game-based learning and helped usher in a major focus on games in, for, and outside of the classroom. Others, such as Prensky (2001, 2006), Squire (2006) and Shaffer (2005, 2006), helped promote the reach of games into different educational settings. Game makers and educators have created games specifically for the classroom, such as *MinecraftEDU*, the *iCivics* series, *Gamestar Mechanic*, and many others. Still others have adopted COTS games for their classrooms. Traditional academic textbook publishers like Pearson and McGraw-Hill have begun focusing on games in and for the classroom (Davis, 2013). Major game companies have explored the market as well, including Valve's (now-defunct) Steam in Schools program, and EA's ongoing GlassLab initiative. Innovative schools like Quest to Learn (Salen et al., 2010) have re-organized around digital game principles. Still others—educators and companies alike—have "gamified" their classes or their programs, attempting to capture the motivational, immersive, and organizational qualities of games (Sheldon, 2012; Lee and Hammer, 2011). In short, there are many ways in which games have been used, studied, and created to support good learning.

There is little talk of *teaching* in and around games, however, nor in the broader literature on informal or digital media and learning. Indeed, regardless of where the learning takes place, teaching is often backgrounded and informal learning research and analysis tends to focus on how the leaner is positioned and what they "pick up" through learning encounters. Many discussions of informal learning do include some discussion (or at least some recognition) of the role of teaching, though often not under that name. Often these analyses refer to the roles of participants as "expert" and "novice," "master" and "apprentice," "trainer" and "trainee," and other similar variations. The act of teaching

is often referred to in similar terms: “apprenticing,” “mentoring,” “guiding,” “training,” “showing,” “helping,” “participating,” “sharing,” “demonstrating,” “coaching,” “telling,” and so on.

This chapter is dedicated to identifying several important themes across research into informal learning, digital media, and videogames that are especially germane to this dissertation. Each of these domains is extensive, and it’s clearly impossible to cover all of the literature. Instead, I’ve focused on two important features: first, what kinds of claims have been made about learning supported and enabled by digital media and videogames and in informal settings more broadly, and secondly how these claims relate to—and where they underplay—the acts of teaching.

Informal Learning

For more than 40 years there has been growing interest in informal learning (see, for example, Knowles, 1970; Coombs and Ahmed, 1974; Lave and Wenger, 1991; Wenger, 1998; Coffield, 2000; Rogoff, 1990; Eraut, 2000; Schugurensky, 2000; Livingstone, 2001; Paradise and Rogoff, 2009; Rogoff, et al., 2012). Much of this research has focused on learning outside of school in places like the workplace, afterschool programs, or museums (Bennett, 2012). Some of this research has suggested that informal learning is actually a different *kind* of learning regardless of where it takes place (Marsick, 2009; Marsick et al., 2008). And many researchers contend that there is overlap between formal and informal learning and that informal learning can happen in school as well as outside of it (Sefton-Green, 2004; Bennett, 2012).

Indeed, even the term "informal learning" can mean different things. As Sefton-Green (2004) points out, informal learning is typically used to refer to one of several different things: "*how* we learn, *where* we learn, *what* we learn, or the relationship between the activity and what is *valued* as knowledge today" (6, emphasis in original). The "out of school" distinction of informal learning is perhaps the most prevalent view (Bennett, 2012). Historically, informal learning has been used to differentiate activities from school-based education as a site of learning but also as an institutionally-backed organizing force. This is especially true in fields such as informal science education, where science museum and activity-centered clubs contrast their programs with "formal" science education in schools. Falk and Dierking (2010) go so far as to claim that 95% of science learning actually happens outside of any classroom. In part, this learning is driven by the disposition of the learner (museums promote curiosity and the drive to engage to learn more, and learners are not under the threat of tests or assessment). These are also design features which promote these dispositions, and indeed a great deal of research exists around museum and activity design. Yet it is rarely talked about as a form of teaching, though creating an engaged, motivated, intentional learner is perhaps the chief aim of a museum.

The "out of school" definition of informal learning is often a distinction about the institution which supports learning (and, by extension, teaching). Schugurensky (2000) defines three different kinds of learning environments: formal, non-formal, and informal. *Formal education*, according to Schugurensky, is highly institutionalized, hierarchical, propaedeutic (serves as an introduction to continued study), and grants certification or accreditation that is usually recognized in some civic sense (e.g. a high-school diploma as

a credential for employment). *Non-formal education* involves organized but often voluntary activities such as sports or music lessons. These activities still employ a teacher of some kind (though, as Schugurensky notes, they are often called coaches, instructors, or facilitators). They follow some curriculum or program of study, and may "test" competencies. They do not, however, often include "prerequisites in terms of previous schooling," nor do they grant accreditation that is broadly recognized in civic activities. *Informal learning*, according to Schugurensky, is a different kind altogether. He goes so far as to call out a distinction between formal and non-formal *education* and informal *learning*. This distinction is meant to emphasize that formal and even non-formal education rely on some institution to frame the activities, while informal learning explicitly lacks any institutional structure. Schugurensky's classifications—and indeed many definitions of informal learning—are in large part distinctions about the power of institutions: the institutions of school and the governing bodies that establish curriculum but also institutions like economies and labor markets. Formal institutions are often charged with credentialing some institutional values (like the value of a "basic education"). Formal education is a kind of societal gatekeeper; it may be small wonder that people seek alternatives to participation and to establishing "what counts" as education beyond what is offered (and punished) by formal educational institutions and why informal learning is so often juxtaposed against school-based education.

Another key theme in informal learning research that relates directly to issues of teaching is the nature of the instruction itself. Formal instruction is often set up as didactic and rigid (such as lecturing), while informal learning is often contextually situated and experiential. Schön (1987), for example, discusses a model of learning (and

teaching) known as the *reflective practicum*, where students learn by doing and reflecting. Importantly, Schön uses the model of reflective practicum in a school setting but distinguishes it from didactic or "formal" teaching methods traditionally associated with school settings. Subsequent theorists and practitioners have taken Schön's basic premise to greater extremes and, combined with theories of discovery learning and project-based learning, have often removed instruction completely from the equation.

Finally, an important distinction about the roles and status of the participants is often a theme in informal learning research. Whereas formal educational settings rely on a "professional" expert whose job it is to teach, often in a directed, top-down manner, informal settings often feature experts, more knowledgeable peers, and novices all interacting throughout the learning process. Scribner and Cole's (1981) study of the Vai people of Liberia and the ways they learned the Vai script outside any formal schooling is an early example of this distinction. Lave and Wenger's (1991) influential research into "communities of practice" argued for learning that is based on participants shared passion or interest in some domain. Like Scribner and Cole's work, Lave and Wenger describe a kind of "social learning." In particular, this sets up a distinction with formal schooling and its orientation towards top-down content delivery. It also changes the nature of the participants (learners and teachers) from rigid, often uni-directional relationships to shifting, reciprocal relationships where people learn through experts and peers alike as well as through their own participation.

In the broadest sense, then, informal learning is often contrasted with formal education (particularly school) and set up as a kind of alternative—an alternative process

and an alternative environment. Jenkins at al. (2006) summarize these distinctions succinctly:

> While formal education is often conservative, the informal learning within popular culture is often experimental. While the formal is static, the informal is innovative. The structures that sustain informal learning are more provisional; those supporting formal education are more institutional. Informal learning communities can evolve to respond to short-term needs and temporary interests, whereas the institutions supporting public education have changed little despite decades of school reform. Informal learning communities are ad hoc and localized; formal education communities are bureaucratic and increasingly national in scope. We can move in and out of informal learning communities if they fail to meet our needs; we enjoy no such mobility in our relations to formal education. (11)

These features of informal learning—fluid membership and participation, ad hoc and interest driven content, malleable practices—align closely with the affordances of digital media, and helps to explain why digital media and learning research has focused so much on out of school, informal learning. I will now turn my attention to this research to examine how claims about informal learning more generally influence those made about digital media and how these claims—based on a distinction that sets informal learning apart from school-based education—often efface teaching.

Digital Media and Learning

Digital media is itself a blanket term that covers a number of different technologies and spaces. These include things like YouTube and video sharing sites, forums, wikis, videogames, blogs, social media sites (Facebook, Instagram, Pinterest), mobile technologies (text messaging, WhatsApp, Snapchat), and many others. Some of these are content creation tools (from the camera on a cellphone to photo editing suites like Photoshop). Some of these are sites where participants disseminate and share their

work (Reddit, Imgur, Flickr). Some digital media is about the practice itself (hashtagging, remixing, creating memes). And new technologies emerge on a regular basis that bring new affordances and new practices.

Perhaps no group has been more involved in researching digital media and learning than the MacArthur Foundation. Their $50 million Digital Media and Learning (DML) initiative has produced some of the most visible and consequential work in the field. The research emerging from DML ranges from theoretical models of learning with digital media (Gee, 2010; Ito et al., 2009a, 2009b, 2013; Grant, 2014), examples of digital media-infused interventions (Larson et al., 2013; Martin, 2014; Rafalow and Larson, 2014), digital media as a gateway for civic participation (Soep, 2014; Kahne, Middaugh, and Allen, 2014; Pfister, 2014), and work that directly addresses issues of schools and educational institutions (Garcia et al., 2014; Carfagna, 2014).

At the most basic, claims about digital media often center on new forms of participation. And, like claims about informal learning more broadly, these claims about digital media and learning often focus on differences from traditional educational settings. Davidson and Goldberg (2009) offer an argument that is common throughout much of the DML literature:

> Technology, we insist, is not what constitutes the revolutionary nature of this exciting moment [in changing approaches to learning institutions]. It is, rather, the potential for shared and interactive learning [….] We argue that the single most important characteristic of the Internet is its capacity to allow for a worldwide community and its endlessly myriad subsets to exchange ideas, to learn from one another in a way not previously available. We contend that the future of learning institutions demands a deep, epistemological appreciation of the profundity of what the Internet offers humanity as a model of a learning institution. (1-2)

While Davidson and Goldberg refer simply to the Internet, most digital media applies to this definition as well since most digital media leverages the connected, networked nature of the Internet. The emphasis in this argument is that digital media reconfigures *how* learners connect and interact with other people and with learning "content", and that this configuration is different (and better) than in traditional school environments.

One common claim about the way these new configurations are better is that it allows more people to be considered experts, and that the community of participants can determine what "counts" as expertise and who to validate (Gee, 2003, 2007; Gee and Hayes, 2010). In a formal educational setting, teachers are credentialed and afforded expert status through a rigorous, standardized process. Yet few students are free to judge the teacher's competency or to certify their expertise. Rheingold argues that this is, in part, the result of school teaching "compliance" (Chaplin, 2013). Digital media, on the other hand, is about disruption and changing the power structure of teachers and learners, as the quote from Jenkins above demonstrates—and this disruption stems from active participation.

Indeed, as Jenkins et al. (2009) argue, digital media provides unique avenues for participation, collaboration, and networking unlike any other media or institution. For Jenkins, the promise of digital media is in the creation of "participatory cultures" which "shift the focus of literacy from individual expression to community involvement" (6). Literacy in this definition means situated knowledge and action, so Jenkins argues that digital media is a means to engage with other social actors in a specific context. And, in conjunction with the quote from Jenkins above, these contexts are generally interest-

driven, voluntary, provisional, and made up of a range of different people with different sets of expertise and goals.

These various people participate at different levels or ways, too. Ito et al. (2009a) describe several types of engagement: "hanging out" (primarily social in nature, with a great deal of reading/watching/sharing but little production), "messing around" (tinkering or playing with production tools and methods) and "geeking out" (deep involvement and participation including content creation, curation, and even analysis). These are fluid definitions, and in some places a participant can "geek out" while in other places they simply "mess around". These definitions also point to *developmental participation*, where participants start by hanging out or messing around and move to geeking out through active engagement.

In other words, participants learn *how* to participate by observing, tinkering, and through feedback from other participants. These other participants are often described as "peers", which generally refers to peers as similar in knowledge rather than age. Peers can range from similar levels of knowledge and experience, to slightly more or less, to high levels of expertise. And, because of the highly complex nature of the networks of participation, peers can be experts in one domain (say, how to create artwork in Photoshop) while being relatively novice in other domains (say, writing fan fiction stories) (Gee and Hayes, 2010). Nevertheless, peer-to-peer interactions form one of the core claims about digital media and learning, and particularly how peers learn from each other (see, for example, Ito et al. 2009a, 2013). Despite the fact that it's easy to see participants learning by observing and listening to others as the result of *teaching* by others, little emphasis is placed on how these other participants actually engage in

teaching. Instead, most of the focus is on what learners "pick up" through their participation and interactions. I will return to this theme below.

Videogames as One Way Forward

Videogames are part of this larger digital media ecology (Jenkins, 2006b). Many of the claims about digital media more broadly have also been made about videogames—including claims about participatory engagement and the way games model learning outside of any school-like context. Just as importantly, many of these claims privilege learning while ignoring teaching in the same ways as other digital media and learning research does.

Two key types of claims about videogames repeatedly emerge about game-based learning that are especially relevant to this discussion. The first type are claims about the nature of the learning environments promoted through games, and in particular claims about ways the design of games and the act of playing games supports good learning. The second type are claims about *what* is learned by playing games. I am especially interested in claims about "procedural" learning and "meta-level" learning rather than "content" learning. Briefly, this procedural learning includes cognitive and non-cognitive skills such as resource management, strategic planning, systems thinking and more. I will now summarize these two sets of claims and highlight a few instances of game-based interventions, and then suggest that games are often misappropriated since game-based interventions often ignore the important role of teaching.

Videogame learning environments. To get to the procedural or meta-level learning, videogames must provide learning environments which support this development. Much of the literature around game-based learning (GBL) focuses on the rich learning features of videogames. Games are interactive in that players must engage with elements of the game and make changes to it as a regular part of their gameplay (Wilson, 2003; Newman, 2004). Games are *experiential*, where players (learners) gain direct experience enacting some event or knowledge rather than passively encountering it (Shaffer, 2006; Klopfer et al., 2009). Videogames provide *deep contextual environments* for learners so that the things they are learning are enmeshed with appropriate supporting cues rather than abstractly removed from relevant content or processes (Barab et al., 2010a; 2010b). Games provide plenty of *opportunities to fail safely*, which provides a low cost for learners to explore and practice in addition to supporting the powerful learning that occurs through failing (Collins and Halverson, 2009; Juul, 2013). Games let players *enact new identities*, so learners can be a particular type of person (or thing) that "lives" the learning at hand, whether that is an extension of themselves as a new being or as someone whose "lifeworld" might be completely different (Holmes, 2013; Waggoner, 2009). Games even provide *deep, continuous assessment* as a native part of their nature, so that the game measures players' performance, gauges their ability to enact appropriate knowledges at appropriate times, and acts as a gatekeeper if they cannot (Shute and Ventura, 2013; Abrams and Gerber, 2013). There are many other related features which draw scholars' and designers' interest when it comes to creating new, transformative learning that school often cannot replicate (Gee, 2013).

One of the most coherent—and influential—works on the nature of game-based learning is Gee's *What Video Games Have to Tell Us About Learning and Literacy* (2003). Much of the research cited above is based, directly or indirectly, on Gee's analysis. Gee lays out a compelling case for games as models for deep learning tied to empirical research into cognitive development, which he develops into 36 learning principles. In particular, Gee describes a series of game design features—such as providing multiple pathways to success and giving copious amounts of just-in-time feedback—that support learning and shows how these mechanisms align with theories of how the mind works. Game design (and even the nature of videogames as *enacted designs*) works in service of good learning. However, while Gee articulates a clear view of how games demonstrate good learning, he also largely neglects the teaching components which support that learning. Perhaps the most interesting observation about Gee's 36 learning principles is how closely they align to good teaching practice without explicitly connecting the two.

Several early themes in videogame criticism (and discussions of game design) more directly approach games and the ways they teach, at least implicitly. Papert's work on the Logo programming language (1980, see also 1993) focused on computers and computer gaming as a vehicle for children's tinkering (a component in his model of "constructionism"). Part of his analysis focused on instructional designs and the ways the Logo language supported good learning through *computational* design. Prensky (2001) offered one of the earliest compelling visions of games specifically for learning; his focus was on both games inside classrooms as well as in other spaces like workplace training.

Prensky's vision, however, was (like many others) towards a "learner-centered" theory of learning which often de-emphasized teaching.

Procedural and meta-level learning thorough videogames. The learning environments made possible through videogames—as interactive, experiential, contextual, exploratory spaces—promote certain kinds of learning. Games are about *things*; there is a great deal of content found in videogames, and there is much research into the ways games frame issues of race or gender or violence or other kinds of topical subjects. This research exists in much the same way as research into other media like film or music or even books also looks at these "content" issues. Games certainly have unique features in this kind of learning, not the least of which is the notion of interactivity, or players "enacting" these issues through the course of their play. I do not intend to outright dismiss these issues (which sometimes fall under the term "games studies" in academic circles).

However, I believe that claims about learning procedural or meta-level knowledge through games is more telling, in particular as it relates to game design and the acts of teaching through games. A number of researchers have recently claimed that videogames are especially good at encouraging "21st-century skills" (Klopfer et al., 2009). The MacArthur Foundation's *Re-imagining Learning in the 21st Century* (2010) describes this claim succinctly:

> Games that require students to solve complex social problems lay the groundwork for them to develop 21st-century skills. In addition to systems thinking, those skills include teamwork, creative problem solving, and time management. (20)

Definitions of what count as 21st century skills differ (for example, the Partnership for 21st Century Skills, the Association for Supervision and Curriculum Development, the Institute of Museum and Library Science, the National Academy of Sciences and many others all offer overlapping but unique criteria). One common theme is that 21st Century skills entail competencies that are often neglected in traditional schooling, an argument that reinforces the central claims of many informal learning and digital media and learning claims.

Bogost (2008) suggests that games are essentially about procedure—and that games use "procedural rhetoric" as a form of teaching and motivating. While content is important (games are about things, after all), Bogost argues that what players really learn is how to manipulate systems and engage in computational processes. Others (especially critics of games in the classroom) have argued that the procedural nature of games leads to students who "play the game" rather than "do the learning" (see Duncan, 2010, for example). Students often focus on the rules or systems of the game and become adept at manipulating these features while never actively engaging with the content (sometimes referred to as "min-maxing," or doing the minimum amount of work for the maximum return). While this may be an economically effective use of their time (and a valuable lesson in and of itself), it may work contrary to the explicit learning goals at hand.

One other problem with procedural or meta-level thinking is that it may not be apparent to the learner. Jenkins et al (2009) refer to this as the "transparency problem". Learners may tacitly understand, say, resource management but may not be able to articulate it outside of the specific context of their gameplay. If nothing else, this points to the need for explicit teaching support throughout gameplay and in other settings where

games are used as learning environments. Some of this support comes in the form of the game design itself, while other forms of support include teachers, peers, websites and so on. However, much of the research into GBL ignores these features and tend to focus on the "game" proper.

Game-based learning in- and out-of-school. Many educators have used games in their classrooms, either as components of the curriculum or to replace the curriculum completely. Examples exist across a range of disciplines, including history (Squire, 2005; McCall, 2011), science (Barab, 2006; Steinkuehler and Duncan, 2008; Honey and Hilton, 2010), rhetorical studies (Colby, Johnson and Shultz Colby, 2013), writing and composition (Robison, 2008; Gerber and Price, 2011), economics and many others. Many of these examples emphasize the games themselves and the learning that occurs, with much less attention paid to the teachers or the design of the game intervention (e.g. class set-up, support materials, follow-up lessons and so on).

There is also a significant body of work examining learning through games outside of the classroom entirely. This literature covers things like organization and management of people in a large virtual world (Steinkuehler and King, 2009), literacy practices (Hayes, 2008; Steinkuehler, 2007), history and civics (Squire, Devane, and Durga, 2008), affinity towards some topic or group (Hayes and Duncan, 2012), modding and programming (Durga, 2012), and even rhetorical and political implications of games (Bogost, 2006, 2008). Some of these studies are intended to highlight the limitations of the current model of school-based instruction and the need to seek alternative methods of

instruction. Others are designed to show how school can adapt some of these features and learning opportunities. Still others ignore any implications for schools at all.

Another recent trend in the game-based learning movement is towards *gamification*, or turning the learning situation *into* a game (see Deterding, et al., 2011; Reeves and Reed, 2009; Dignan, 2011; Zichermann and Cunningham, 2011; Schell, 2010). Examples for gamifying the classroom include Kapp (2012), Sheldon (2012), and Decker and Lawley (2013). Even more has been said about gamification outside of the classroom, from gamifying consumer platforms (Zichermann and Cunningham, 2011) and strategic business planning (Werbach and Hunter, 2012) to gamifying one's entire worldview (McGonigal, 2011; Schell, 2010). Much of the literature around gamification focuses on features that make games motivating, engaging, and enjoyable and not *necessarily* because they represent good teaching and learning platforms. Learning (and teaching) in much of the gamification literature is tangential to—and not the driver of—gamification implementations.

Several other recent examples seemingly blend the boundaries of in-school, out-of-school, and gamified teaching- and learning moments. Khan Academy, Codeacademy, and other "tutoring" sites use many of the principles of gamification (like earning points or badges and following a "quest-like" structure) in teaching math principles and programming languages. Groups such as Badgeville, Badgestack and Mozilla's Open Badges program let users add a game layer to their websites or other programs; schools, companies, and nonprofits have adopted this gamified model for engaging and directing user (learner) interactions. Again, these instances often focus on the motivational features of games to drive engagement without much overt emphasis on the teaching implications.

Efficacy and the nature of teaching in games. Despite the large body of literature around game-based learning (of which I have only provided a small sample), the efficacy of game interventions is not clear cut. Tobias and Fletcher's (2011) comprehensive literature review and meta-analysis of more than 200 studies suggests that there are some demonstrable learning gains and some effective game interventions, but that the overall picture is not conclusive. This is at least partly due to the relatively short history of game-based learning investigations in general (less than 20 years as a serious field of study). It may also result from mischaracterization of what *kinds* of learning (and teaching) games do well and a misapplication of games towards the wrong learning goals.

The effectiveness of game interventions also stems from the ways we often fail to conceptualize games as part of *teaching and learning systems,* and that games really model good teaching only in conjunction with other interventions directed by teachers, designers, peers, and parents. Gee (2007) argues for conceiving of "big 'G' games" which include not just the software or game proper, but a litany of extra-game resources like websites, forums, blogs, machinima, walkthroughs and tutorials, cosplay, fan conventions, fan fiction and art, game reviews and many others which together make up the "Game." Jenkins (2006) argues that we should view digital media as part of an "ecology" made up of various different formats (video, text, social media platforms, fan-made "emergent" media and official "top-down" media all working across the various modes of representation towards a "convergent" or "transmedia" experience). In the same way, we might conceptualize of "big 'L' learning" and "big 'T' teaching" as a more effective model of teaching and learning moments. Games represent a tremendous area

for exploring this phenomenon and serve as inspiration for rethinking our current models of learning and teaching in- and out of school. I expand this theme in greater detail in Chapter 6.

What DML, GBL, and Informal Learning Research Gets Right

I want to be explicitly clear here that there is a great deal in the digital media and learning and game-based learning literature that I fundamentally agree with. My aim here is to critique these theories and to modify them to address the critical issue of teaching, one which seems to be ignored or underplayed. At the same time, the foundations for much of this research align with my own conception of learning and my own definition of teaching. I believe that much of this research simply has missed half of the problem and half of the answer, and I aim to rectify that here.

For example, the recent *Connected Learning: An Agenda for Research and Design* report (Ito et al., 2013) sponsored by MacArthur's DML initiative highlights several fundamental problems with traditional school-based education, including issues of access, applicability, teaching methodologies, and equity. These are legitimate concerns, and the *Connected Learning* report makes a compelling case for how traditional school ignores or exacerbates these problems. However, as I'll argue below, they miss a larger point in working towards a solution by minimizing the essential role of teaching as part of the equation. In this way, the *Connected Learning* report is both insightful but incomplete.

Similarly, work on game-based learning contains a great deal of important insights into the nature of learning (and, though often unspoken, the practice of teaching).

Much of this research is based on socially situated cognitive models of learning (Sefton-Green, 2004) which emphasize the cultural roots of learning. Similarly, many of these models also descend from Dewey's conception of learning as life-long and practically-based endeavors. Again, these are theories which I believe in and use as a basis for my own definitions of teaching and learning and as a starting point for my critiques. I do not disagree with them; instead, I find that these theories are often simply misapplied.

There are also examples of game-based teaching that more closely adhere to the general arguments I make in this book. Salen et al. (2010) describe a model of curriculum development and instruction called Quest to Teach that they used in an innovative charter school in New York. This school was designed to leverage the kinds of learning and instruction modeled by videogames, especially the problem-based and experiential nature of deep learning environments. Salen and her team recognize the alignment between game design and teaching practice and have designed a formal educational environment which blends the realities of public educational institutions with methods of informal learning (and teaching). The Quest to Learn school is perhaps the closest model to a blended formal/informal learning environment that I try to articulate here, though it is not above some criticism (in particular, the way problem-based instruction is often left up to the students to re-create the fundamental principles underlying the problem). I greatly admire this model, though I still believe that there is room for improvement.

The Role (and Absence) of Informal Teaching

Throughout this review, I have stressed the way much of the informal, digital media, and game-based learning research privileges learning while minimizing the role of teaching. I want to focus on this issue more fully here. Even when texts explicitly deal

with issues of teaching (see Squire, 2011, for a common example), they often focus on the learning that goes on through the course of play. This may be inadvertent, or even well-intentioned—learning is "measurable," while teaching is more abstract (and hard to capture) and thus harder to "prove". It may also stem from the same bias as other discussions of informal learning in that gaming (i.e. *not* school) cannot be the site of the *professional act* of teaching. Gaming in particular has also been culturally positioned primarily as a recreational activity and thus removed from "serious" activity and formal settings like schools. These suggestions are (mostly) conjectural, but they nevertheless point to a significant gap in the literature around games and teaching.

As a crude example, a count of the term "learn" the *Connected Learning* report (Ito et al., 2013), includes 658 results (which, of course, includes variations such as "learning"). Accounting for redundancies, marginal cases, or formatting issues (including things like results in the table of contents or in the footer), the total is still over 400 results, in a 99 page document. In contrast, a search for "teach" returns 36 results; excluding similar exceptions as those described above, the result is less than 20. That is greater than a 20:1 ratio of uses of "learn" (or variations) to "teach." Other documents similar to the Connected Learning report contain similar results. As yet another crude example of the different emphasis on "learning" and "teaching" in informal contexts, a Google search of the term "informal learning" results in roughly 447,000 results. A search for "informal teaching" results in just over 55,000 results - *and my blog is the first result*. If nothing else, this indicates that there is not much serious work being done (at least publicly) on teaching in informal settings.

As a more specific example of the way teaching is treated in much of the research, consider the following statement from Ito et al. (2009b):

> Youth using new media often learn from their peers, not teachers or adults, and notions of expertise and authority have been turned on their heads. Such learning differs fundamentally from traditional instruction and is often framed negatively by adults as a means of 'peer pressure.' Yet adults can still have tremendous influence in setting 'learning goals,' particularly on the interest-driven side, where adult hobbyists function as role models and more experienced peers. (2)

This quote makes two things abundantly clear. First, it suggests that "teachers" are professionals, distinct from "peers" or other "adults." It indicates a bias towards teaching being exclusively the province of "formal" (i.e. school) settings. Second, by setting up teachers as professionals, it means that "peers" cannot be teachers. In fact, it makes the first claim in the quote almost nonsensical: youth learn *from* peers, but peers cannot "teach" (at least, not in the formal sense). How then did the youth "learn from" their peers? Again, this quote demonstrates a clear bias towards learning at the expense of teaching almost to the point of absurdity.

Teaching and Informal Learning

The Ito quote above is one of the most telling because it explicitly separates "informal learning" from teaching. Other discussions of informal learning do often include some discussion (or at least some recognition) of the role of teaching, though often not under that name. Indeed, the *Connected Learning* report repeatedly uses the term "supporting" where "teaching" might be appropriate or even more accurate. While it may be hard to say with certainty why the term "teaching" rarely appears in talk of informal learning, it's possible to tease out at least two important themes.

One is that "teaching" is a profession, and the professional act of teaching cannot exist outside of the professional space (i.e. school). Most talk of teaching is bound up extremely tightly with discussions of the institution of school. School itself is problematic, and talk of teaching often deals with the practical realities of a modern classroom (managing large class sizes, accounting for state- and federally-mandated testing, meeting curriculum standards and so on). Schools are also the site of many other non-pedagogical issues (institutional and organizational realities, classroom populations, demographics, family issues, personal issues and more) which nevertheless impact teaching. Schools are, in essence, complex systems, and talk of teaching in schools often must navigate these complexities.

The second major theme is that discussions of school (usually regarding *public* education) often become politically and ideologically charged (for instance, Freire, 1970, 1985; Bowles and Gintis, 1976; Finn Jr., 1991; Giroux, 1984, Apple, 1988; Chubb and Moe, 1990; Glickman, 1993; hooks, 1994). Teaching—since it is so bound up with school—becomes an ideologically motivated act (and thus politically vulnerable target). Criticizing teaching, therefore, can take place not on evidence-driven grounds of what is *effective* and meaningful in the act of teaching, but on differences in political worldviews about the *role* of teaching in public (and publicly funded) education. It is not surprising at all then that many want to leave talk of teaching behind at school and look for new ways of examining how people learn free of the institutional, political, and ideological challenges of the classroom.

But leaving talk of teaching behind at school creates two significant problems. The first is that it ignores all of the good teaching moments that happen outside of the

classroom, and with it all of the events, the actors, the designs and intentions, and the actions that lead to learning outcomes. More directly, it neglects the tremendous benefits learners get from being exposed to good *teachers* and good *teaching* that contribute to future success (both in- and out of the classroom)—most importantly the building of a *deliberate learner*, who is meta-aware of learning situations and directs their own future learning. That is, one primary goal of teaching is to create models of action, lines of inquiry, strategies for approaching problems, and beliefs about the act of learning itself that learners take to future learning events. Recognizing that much informal (out-of-school) learning is the result of good teaching (in the explicit design of the task at hand, in the implicit design of the tools or situations of the learning event, and even in the deliberate support and guidance of other peers, mentors, and tools) validates the act of and the effects of good teaching regardless of where it takes place. It also highlights the potential disparity—and the damage it can do—between those with plenty of access to good teachers and good teaching and those without.

The other significant problem in neglecting talk of teachers and teaching in informal contexts is that it leaves the act of teaching at the whim of all the ideologically motivated talk (which often turns to action, through legislation or theorization) surrounding school. As a consequence, curriculum and pedagogy often develop from politically biased starting points rather than from evidence of what techniques or concepts are demonstrably effective in teaching. Ideologically motivated policy and practice rarely reflect what *good* teaching is.

The theory of constructivism (and it's many more recent guises like "problem based learning," "discovery learning," and "inquiry learning," among others) serves as an

interesting example. Based in part on Dewey's (1897, 1916, 1938) insights into education, constructivism proposes several core features: that learning is an active process, a social activity, contextual, strategic, time- and resource-intensive, and requires motivation on the part of the learner (Hein, 1991; see also Jonassen, Mayes and McAleese, 1993; Bruner, 1961). Many of these features turn out to be empirically true (see especially Hattie and Yates, 2013). One early thread of Dewey's, however, was amplified in subsequent theorizations of constructivist models which highlights the effects of ideological (and not evidential) design: the role of the teacher as facilitator. In Dewey's (1897) original argument, the role of a teacher was not that of the distributor of information to passive recipients but as a "partner in the learning process, guiding students to independently discover meaning within the subject area" (37). Dewey figuratively repositioned the teacher in the classroom (leading ultimately to King's (1993) famous description of the "sage on the stage" and the "guide on the side") but left a strong role for the teacher in the guidance and support of the learner as they "constructed" new knowledge. Subsequent iterations of the theory further backgrounded the role of the teacher in the process, until students become self-directed, self-motivated investigators of non-structured, "real world" problems who discover and construct (or reconstruct) massive amounts of domain-specific theory and knowledge (see Mayer, 2004, for a critical overview) operating with minimal guidance or interventions.

The evidence for good learning, however, disputes the effectiveness of this model—indeed, it rather thoroughly contradicts it. Kirschner, Sweller, and Clark (2006) provide a pretty damning argument against this form of "minimally guided" educational theory and suggest that novice and intermediate learners benefit enormously from direct

instruction and guided (well designed) problems. Hattie and Yates' remarkable meta-analysis *Visible Learning and the Science of How We Learn* (2013) provides a similar argument based on the analysis of over 900 research studies: learners overwhelmingly benefit from interventions (or, more accurately, from *well designed*, *well timed*, and *well executed* interventions). Theories that espouse minimal guidance cannot, in essence, be based on empirical evidence about good teaching; they must stem from some other motivation. And while the argument is too large (and possibly too over-determined) to be explored here, it is probable enough to suggest that removing the teacher from the learning event must result from some ideological problem with the *act of teaching* itself. At the very least, it is supported by Bruner's (1961) argument that learners best remember concepts they have discovered on their own rather than through instruction by others. Combined with a view of education as exploitation, colonization, or oppression fashionable in Marxist, Post-Colonial, and other philosophies which gained much intellectual cache beginning in the 1960's, it is easy enough to see how removing teachers from the learning activity satisfies a particular ideological viewpoint.

Rehabilitating Teaching, Formally and Informally

Whatever the reasons teaching has largely been ignored in the informal, digital media, and game-based learning literature, there *is* a great deal of teaching that occurs in and through games. I don't believe that this omission is malicious in intent (though there certainly are ideological perspectives that denigrate teachers and the act of teaching, as described above). Indeed, I believe many of the same scholars and designers I've listed

cited do recognize the ways games teach, at least implicitly, though they may not themselves refer to it as "teaching."

So what can be done about this? One task is to rehabilitate the act of teaching and the role of teachers. If, as the evidence from Hattie suggests, there is a distinct and meaningful role for teachers in facilitating good learning, then ensuring that discussions of learning—in formal and informal settings alike—account for teaching is critical. It might also be useful to de-couple the act of teaching from the problematic relationship with school in order to legitimize all the places that teaching (i.e. any event which uses some combination of the *teaching acts* outlined in Chapter 4) occurs. Finally, the act of recognizing and legitimizing teaching must include not just human teachers but all of the objects and tools (like videogames) which can teach, and can thus extend our definition of "teachers" to also include designers, practitioners, and even objects.

To do so, I will next turn to the *act* of teaching. I will operationalize teaching to show *how* it occurs, regardless of setting. This move does two things: first, it sets up a theory of teaching that covers formal and informal settings alike, so that the distinction between them becomes less important; second, it provides an analytical tool to look at teaching as an active process made up of component actions, much like language can be understood in part by its grammatical composition. Like language, however, grammar alone is not enough to understand its meaning and use. Once I have established the set of teaching acts, I will then turn to specific examples of teaching acts to examine how teaching occurs within a particular context. From there, I will make a case that teaching is an integral component of learning in any setting and is not solely the domain of school or other formal educational settings.

CHAPTER 3

VIDEOGAMES AND TEACHING AS DESIGN

This chapter and the next will develop the central theory about teaching that I will use throughout the rest of the dissertation. I wish ultimately to define teaching as an active process of organizing and optimizing conditions for uptake. The current chapter is dedicated to describing teaching as a *kind of design* which creates opportunities for deep learning to occur, learning which aligns to theories of experiential, associative, and social cognition. The next chapter builds on this design process in order to operationalize teaching by defining a set of *teaching acts*. I argue that anywhere some combination of these acts occurs, it "counts" as a *teaching event*. I then outline a set of *good teaching principles* based on Hattie's work on Visible Learning which encompasses the arguments I make on the roots of deep learning, how teaching optimizes these learning experiences, and the various actions good teaching uses. Throughout both chapters, I will look at ways games are designed to provide good experiences for learning, how they use various teaching acts and how they honor these good teaching principles.

While this theory applies to games, it also applies to teaching more generally, and so this theory furthers my broader claim about the nature of teaching regardless of where it takes place. I will therefore look at ways these acts sometimes operate in a traditional sense (e.g. in a school setting). I will also show how teaching manifests in videogames to stress that these acts occur across a range of spaces, actors, and content and that we should broaden the kinds of activities which we consider teaching to include those that leverage these various teaching acts.

Games teach a great many things. A videogame teaches players how to use the system of the game (interface, mechanics, rules); it teaches players how to behave in the game (by taking on the various identities of the character or agent within the larger context of the gameworld); it can teach cognitive skills (like resource or time management, number sense, pattern recognition, and spatial awareness) and non-cognitive skills (determination, intuition, resilience); it can even connect players to larger themes in the world (like historical events, moral scenarios, or pressing political issues).

There is some controversy over what games teach, and in particular about using games in formal educational settings (including overtly controversial things like violence, misogyny, or racial issues as well as other controversies like time-on-task and play as a productive activity). Plenty of studies explore issues of content (see, for example, Devane and Squire, 2008; Jenkins, 2006a; and Bogost, 2008). The content issue is certainly important, as I argued in the last chapter, but for this study I am far more interested in *how* games teach. It is true that content features can drive much of the learning at hand, but normally it is in service of those other things listed above (how to play, how to succeed, and so on). Good games—even controversial games like *Grand Theft Auto* and *Call of Duty*—ultimately teach players to become strategic actors enmeshed in a complex system of the game's rules and design, affordances and limitations of the game, and their own performance.

It is this phenomenon I am primarily concerned with: how a game creates a well-defined problem, supports and guides the player towards success, and then allows the player the freedom to practice towards mastery. It is true that games are about ill-defined problems, too (Steinkuehler, 2006), and increasingly games are about aesthetic or

emotional experiences (a game like *Gone Home* has few "major" problems and is instead about uncovering the story and history of a family; *Flower* uses a relatively simply "ring" mechanic to create a relaxing bodily experience, and so on). These are not inconsequential components of gameplay, and I do not want to gloss over them completely. For the purposes of this dissertation, I want to consider these features part of the problem set that games create while at least recognizing that they are different than "well-defined" problems. Instead, I want to treat them as "kinds" of problems that collectively build the experience of the game.

Games use features of *design* (what types of problems the player will encounter, what possible solutions exist, what constraints are necessary) to create these experiences. As Gee (2003) pointed out, players must be able to learn how to play the game or else they might simply turn it off. In other words, the game *needs* to teach the player to be successful, and uses many different teaching acts to help the player reach it. The game leverages *motivational* elements to keep the player engaged and progressing (what kind of person they get to be in the game, what are the player's own goals and how do they relate to the character's goals, what is the nature of the problems they will face). The game *shows* and *tells* the player what success looks like and how they can realize it (by outlining clear goals, demonstrating how to achieve these goals, and providing plenty of opportunities for the player to see their actions play out). The game also *manages the attentional economy* of the player to avoid overloading or distracting them (using progressive "levels," introducing features in a gradual or linear way). The game must *orchestrate participation* in the game in some meaningful way so that players can enact gameplay (they must provide input of a particular kind so that the game progresses). The

game must *assess* the player's performance (whether they solve the task) as well as assess the game's ability to present the problem sufficiently (usually after lots of iterative design, playtesting, and analysis long before it reaches "market"). The game has to provide meaningful *feedback* to the player on their performance (how they did, what they might be able to improve upon, alternative strategies and so on). And it uses these features (teaching acts) in intricately related ways (motivation is built into the design, showing/telling are used to manage the attentional economy, and so on). In short, a good game can effectively use teaching acts more or less independent of content, so long as they align with effective teaching strategies and learning goals.

Games are not made from whole-cloth, of course. Games are the product of game designers, people (usually many people) who make particular choices about the end experience (the game itself). I have been using the phrase "games teach" so far to suggest the "thing" players (learners) interface; that is, games are the product (or text or object) that players experience, manipulate, and learn through. It is therefore more accurate to say "game designers teach through the game" but this is a bit of an unwieldy phrase, so I will mostly continue using the former. Nevertheless, I want to make it explicitly clear that games *themselves* do not possess some inherent power or agency but are simply a medium for interactions between the game design (teacher) and the game player (learner). This is akin to saying that books do not teach, but that they are the site where an author and a reader meet to (ideally) collaboratively make meaning. Games are perhaps unique in that they are by nature built around a great deal of player input (input that is fundamentally different than the turning of the pages of a book, say). This phenomenon is often described as *interactive*, though this is not an uncontested term (see Wilson, 2003,

and Newman, 2002, for example). I am not especially interested in whether games (any particular game or all games) are interactive, or passive, or both, or neither (indeed all games are probably all of these at some point). I do wish, however, to suggest that there is something interesting in the nature of games in that the relationship between the maker and user is fluid, negotiable, and subject to a great deal of the player's decision making and participation. The site of this participation is often the game itself (though in subsequent chapters I will argue that extra-game sites are also part of a network of participation).

Indeed, the role of the game designer is especially illuminating in light of the theory of teaching I am developing here, and I believe that looking at the way game designers make choices about how to frame, present, and promote participation in a game aligns very closely with these same features of good teaching. In particular, the way game designers build engaging experiences which capture the mind's need to seek patterns, build associations, face (not too difficult) challenges with clear goals, and develop intrinsic motivation from solving those challenges seem to mesh very well with current theories of the way the mind operates and the way learning works best. Although we have not traditionally thought of game designers as teachers, they often demonstrate very effective teaching methods. This chapter is dedicated to exploring the way teaching relates to game design and what that might tell us about teaching more generally.

Teaching as Designing

Teaching is, ultimately, in the service of learning; any discussion of teaching must deal with learning in some manner. Earlier I made a distinction between creating and

optimizing opportunities for uptake (teaching) and actual uptake (learning). I made this distinction to stress that learners play some role in the "transaction" of learning, and that teaching is not necessarily causal to learning. Indeed, I am trying to avoid problematic discussions of what "causes" learning. This is a complex and tricky problem indeed. Is it neurons forming chemical or electrical bonds (is it physiological)? Is it the brain's readiness to receive input and manipulate it (is it psychological)? Is it the structures that allow for understanding and organization, like language (is it cultural)? Is it the ways in which these events are encountered, and possibly how they are purposefully arranged (is it externally organized)? This list could certainly go on. My point is that trying to identify causation in learning is really just an exercise in declaring what part of the complex mind-social-world system is most important.

Learning through patterns of experience. To this end, I want to make three specific conditions clear which form the foundation of the theory of teaching I develop. One foundational condition is that we learn through experience. This theory is based on research into situated and embodied cognition which claims that all learning stems from interactions with the world, and that these interactions become encoded within us as a set of experiences which we can call on as we interact with the world at large (Glenberg, 1997; Barsalou, 1999; Dourish, 2002). Experience is a thread which ties many of the physiological, psychological, personal, and social features of learning together.

The second foundational condition is that the mind is an associative tool that makes sense of the world by adapting previous embodied experiences to subsequent encounters. This theory also stems from situated and embodied cognition research (see

Gee, 2004) as well as linguistics (Chomsky, 1968), learning theory (Bereiter, 2002; Barab, 2006), and even into classical antiquity (Aristotle, for example, articulated early theories about Reason's ability to order Perception through various "analytical a priori propositions"; see Anderson and Bower, 1973). This suggests that what the mind is really good at is seeking patterns in any new encounter that fit into previous experiences; as these new encounters are processed, we can associate them with other similar (or dissimilar) things to build networks of experiences which help us understand the world. Of course, this tendency of the mind as an associative pattern seeker also leads to finding *false* patterns from an encounter; the brain is very good at seeing faces (as I discuss below), and so we often "see" faces in clouds or in a piece of toast that aren't truly there (the pareidolia effect). Further, as these networks develop and become more complex, we can build abstract and generalized models which help us predict and direct our future encounters.

The third foundational condition is that the human mind is a remarkably social instrument, finely tuned to social cues like body language, facial features, vocalizations and so on (Tomasello, 1999, 2014; Aronson, 1972). Even more interestingly, some theories suggest that we actually think *through* other minds (including language and other sign systems) and that we are ultimately wired for *social cognition* (Vygotsky, 1933; Bahktin, 1986; Rogoff, 1990, 2002; Willingham, 2010; Gee, 2014). Willingham goes so far as to state that "[t]he mind is not designed for thinking" (3) and that we do everything we can to *not* think. Thinking, according to Willingham, is resource-intense and may lead to dead ends (see also Kahneman, 2011); thinking is, in other words, quite risky, so the human mind has developed a capacity to offload much of this risk onto other minds (and

tools)—to, in effect, spread the risk among lots of other people. We rely on things like language, communal memory, and familial (and later institutional) authority to offset the risks of thinking. Appropriately enough, this is also the fundamental root of teaching as a native human endeavor, since social cognition relies on shared participation and transmission of ideas, problems, and actions across many different minds. It is also an important feature of 21st century life in which many people increasingly participate in a mediated, networked social world.

Uptake as good learning. So far throughout this dissertation, I've used the terms "learning" and "uptake" somewhat interchangeably. Here I want to consciously make a distinction between the terms for two reasons. I've already alluded to one reason in that learners need to do some work. Uptake suggests that learning is more than just receiving input but is instead actively converting input to some action (where "knowledge" is also an action). The second reason is that uptake refers to a *kind* of learning where the learner comprehends and uses some experience in some meaningful way. Indeed, not all learning is the same; rote learning or simple recitation are also kinds of learning, but perhaps ones that are not all that meaningful. Uptake suggests that the learner "gets" the learning and can use it for some purpose beyond mere regurgitation.

In fact, I want to point out that I am not seeking a single definition of learning here but rather to suggest that learning is a *feature set*. Although learning is not all the same (in the way that rote or superficial learning is different than "deep" learning), all learning may share some features, and each learning event may emphasize some features more than others. The difference between deep and superficial learning may be one of

degree; deep learning may engage all of these features while superficial learning may only emphasize one or two, although all of the features may be present in some manner. I am most interested in thinking about this "deep" learning which leads to uptake (an active application of experience), and what conditions lead to it. From there, I can turn to teaching (designing experiences) which promotes this kind of learning.

Below I outline several features that make up "good" learning. Much of this is based on Hattie's Visible Learning work (which I will return to more fully in the next chapter in regards to teaching), though it is also supported by research into learning from a variety of fields, as indicated. Good learning (uptake) requires some combination of the following features:

- There must be something "at stake" for the learner. The learner must care about the process, their active engagement, and about how they will use it;
- The experience must connect to some prior experience (it must be a recognizable pattern) in some meaningful way;
- The amount of effort required to think (and learn) must seem worthwhile;
- The learner must have some sense of what success (learning) looks like and know when they succeed; they must be able to self-assess their progress;
- The learning "environment" (including things like "content" but also physical space, social arrangement, or the learner's emotional state) must be free of distractions so that the learner can focus on the relevant parts of the experience;

- The learner can move from concrete or specific examples to more abstract generalizations through continued experience and associations.

It is interesting to compare these features of good learning with Csikszentmihalyi's theory of "flow" (1990). Flow, according to Csikszentmihalyi, is one of eight "mental states" that people experience when engaged in a task (including the task of learning). These other states (anxiety, apathy, arousal, boredom, control, relaxation, and worry) describe various configurations of the relationship between challenge and ability. Although Csikszentmihalyi wasn't talking about learning exclusively when describing these mental states, the flow state aligns well to the theory of good learning (uptake) described above. In the flow state, a person is working on a difficult problem but not so difficult that it overwhelms them; they are in the "sweet spot" just beyond their current ability but feel like they can be successful. Indeed, this notion of the spot just beyond the learner's ability is not exclusive to Csikszentmihalyi but was also theorized by influential learning theorists like Vygotsky (1933) and Piaget (1954), among others. Vygotsky's theory of the Zone of Proximal Development (ZPD), for example, relates to a learner's capacity to learn something that they cannot do by themselves but can do with the help of guidance (that is, with the support of teaching). The theory of ZPD is an especially important bridge between optimal learning and teaching, though the latter is sometimes deemphasized and is treated as though a learner simply achieves this development through their engagement with some task. Nevertheless, ZPD and Flow both result from good learning conditions described above in that the learner has something at stake, can connect new experiences to older ones, and has some belief that they can close the "learning gap."

Teaching as designing experiences good for learning. Let me return again to teaching more directly. I have just made the argument that humans learn through experience. But not all experiences are equal, and not all experiences are necessarily good for learning. If I stick my hand in a fire, for example, I will undoubtedly learn that it was painful and that I should not do it again. It's a relatively clear lesson. Unfortunately, it came at the expense of burning my hand in order to learn it. While the experience of burning my hand did lead to a positive learning event, it was quite costly. So one core function of teaching is to create experiences which are not only good for learning but which also reduce the costs of learning. In other words, teaching helps make learning more *efficient*.

I want to be very careful here to note that learning is always "messy" in the sense that learning takes work, the learner can be confused or overwhelmed at points, and sometimes it takes many encounters for learning to occur. There is also a growing body of literature on the pivotal role of failure in learning (see Juul, 2013, for example). Failure, multiple attempts, confusion and frustration—these are not often features associated with efficiency. Indeed, the term "efficiency" has largely taken on a particular neoliberal meaning of late in which efficiency is associated with the reduction of outside influences, interventions, regulations and so on—this is the efficiency of laissez-faire economic liberalism. In this sense, efficiency and teaching (in the form of teaching interventions) are contradictory. Even if we grant that the colloquial definition of efficiency may allow for teaching interventions because they will reduce the time or effort of the learner (and therefore make learning more "efficient"), it suggests that

teaching is simply a way to do away with the "mess" of learning. This is true, but only partly so. It is true in the sense that teaching may reduce or prevent *wasted* effort—chasing dead-ends or "garden paths," or, in other words, work that doesn't lead to learning. This is the kind of risk that Willingham suggests has made us biologically pre-disposed to *not* thinking. It is not true in the sense that teaching reduces the need for the learner to do some work; learning, as I have been arguing all along, is an active process. All teaching does, in its broadest definition, is organize the learning event as carefully and clearly as possible to promote the greatest chance of uptake while reducing the cost of learning. To extend from the metaphor above, teaching makes learning efficient by helping me learn not to put my hand in the fire without the need for me to burn myself in order to learn it.

Since we learn through experience, and teaching is meant to promote efficient learning, one core function of teaching is to create experiences that are good for uptake. Much like videogames, these experiences are also not made from whole-cloth. They must be actively shaped. The teacher must make choices. These choices include things like content, style, order, and so on (in many ways, these are rhetorical choices, a theme I return to more fully in Chapter 7). These are *design* choices, choices made about the kinds of experiences the learner might have. So I can revise my description again to state that teaching is a way of *designing experiences good for learning*.

These designs are the basis of what makes something "teaching" and not just "telling". Design is the organizing principle for all of the teaching acts described in the next chapter, and the way that the teacher (as a designer) ensures the good teaching principles I will later develop occur. These designs can be active, explicit interventions

(giving directions or feedback, modeling some action and so on) or more implicit (setting a professional or collegial tone; structuring and organizing some series of activities). These designs can be carried out by people (teachers) but they can also be built into tools (like videogames).

I use the term "designing" in a very broad sense which includes *creating* these events as well as *managing* them. In this way, even ad-hoc or unscripted teaching is accounted for. For example, a child might ask a parent about where wood comes from while they are working on a craft project. The parent may not have a "canned" response, nor have intended for the conversation to take such a turn. They did have some control over the kind of environment the event takes place in (they chose to work on a craft project using wood). They certainly have control over how they answer (what kinds of things they will emphasize or ignore, the types of follow up prompts, opportunities to call on other things like books or the internet or a nearby tree and so on). In an event like this, there is still the opportunity for teaching to happen even absent pre-meditated learning goals and teaching interventions, and this too is a form of "designing" an appropriate teaching situation.

In school-like teaching, design might refer broadly to an individual intervention (an example or a lecture) all the way to the overall school curricula. For example, a teacher might create a lesson for talking about a single topic in their physics course (say, the topic of gravity). They might assign readings to the students (readings which are teaching events in their own right). They might also create a lecture over the topic for a class meeting after the students read the material. They could provide some kind of hands-on time with the concept (a lab or demonstration). Each of these actions (readings,

lectures, labs) are different teaching events (as I describe them in Chapter 4) and each is a designed intervention. They are also bound together in some way so that they are part of a singular, overarching design.

What do these designs look like? They actually look somewhat different from the perspective of the learner and the designer, but are, of course, interrelated. Since teaching is in the service of learning, they must absolutely address the mechanisms through which learning occurs which I have described above (they must be experiential, they must allow for pattern association, they must engage the learner, and so on). For a learner, then, an experience good for learning must have the following features:

- The learner has actions to take towards solving the problem;
- The learner has clear goals and a sense of what to do in order to learn;
- Something must be at stake for the learner (they have affective involvement);
- The experience must be constrained so the learner avoids cognitive overload;
- The leaner can "plug in" to other tools and other minds.

When these features are present in a given experience, it leads to an optimal learning environment and, ultimately, to uptake.

For the designer (teacher), there are several ways to design for these kinds of optimal learning experiences. Experiences designed for uptake (teaching), much like learning, can also be thought of as a feature set. That is, these designed experiences may emphasize some features over others, though they all share some combination of features

which support good learning. So the act of designing revolves around a set of features in order to create the experience itself, including:

- Organized to highlight or foreground some information, process, or sensation while minimizing or backgrounding confusing or superfluous information;
- Ordered to emphasize some pattern clearly;
- Provide some challenge that is non-trivial, interesting, and useful;
- Set some goal or success state and some way to measure progress;
- Provide useful feedback.

Some of these features, as I'll argue below, are so important that they are specific teaching acts (highlighting useful information, for example, is accomplished by managing the user's attentional economy). But all of these features are necessary for an experience to connect to the features of uptake and to promote deep learning.

Videogames as Designed Experiences

Videogames are by their nature "designed experiences" (Squire, 2005). I find it especially illuminating that many game designers have identified not only the importance of designing experiences (learning opportunities) but also recognizing many of these features of good learning, if not always in those exact terms (see especially Costykian, 2002; Salen and Zimmerman, 2003; Koster, 2004; Fullerton, 2008; Shell, 2008). As Gee (2003) has pointed out, game designers have intuitively developed deep learning goals and teaching methods as part of their design process by necessity, as players must learn how to play the game and understand their performance in order to remain engaged. Bad

teaching or shallow learning both risk losing the interest of the player (and, in turn, their continued participation).

Koster's *A Theory of Fun* (2004) provides some of the most insightful descriptions of the relationship between game design and teaching as a design process. Indeed, Koster's claims mesh with a great deal of the research into cognition and learning described above. Koster claims that the mind may not necessarily *want* new experiences since they "might force a whole new system on the brain, and often the brain doesn't *like* that. It's disruptive," (42, emphasis in original). Instead, it seeks "data" which can fit into previously established patterns (since humans are phenomenal pattern-recognizers). The challenge for game designers (and any designer of learning experiences) is in creating interesting "data" sets that both connect to the player's previous experience and which present something interesting and novel enough to keep the player playing. Koster's answer for this, in general terms, is that game design is about promoting "fun," in which "[f]un from games arises out of mastery. It arises out of comprehension. It is the act of solving puzzles that makes games fun. In other words, with games, learning is the drug," (40). While some theorists might quibble with Koster's preference for the "mechanical" nature of his description (rules, puzzles, mastery of problems) at the expense of things like aesthetic or narrative, what Koster is arguing is that the mind (as a learning machine) experiences great joy in "figuring something out" and in seeing new patterns and new ways of organizing those patterns. Game design is about creating experiences which bring these moments to light.

Understanding games as experiential spaces isn't unique to videogames; Callois (1961), for example, outlined a set of experiential states during play (including

competition, simulation, “vertigo” and others). Nor are games the only medium designed explicitly as experiences; architects often create spaces to be experienced (Frank Lloyd Wright’s belief in “compression” when entering doorway and “release” upon entering the room [Hildebrand, 1991]), and music, painting, or many other arts are similarly intentionally created as experiences. Some designs are mean to drive behaviors through “experiencing” them, sometimes even subtly (the Camden Bench, for example, is designed to promote brief usage by people waiting for a bus by including only small, irregular surfaces; people cannot linger because it is so uncomfortable and the “experience” of the material object helps influence behavior or, in other words, how to learn to use the object). There is no shortage of potential examples, from clothing to sculpture to human-computer-interfaces. But there does seem to be something particularly illuminating about the way games are designed to create deep learning experiences by their very nature.

This is at least part because games are problem solving spaces, ones which involve both well-structured and ill-structured problems (Steinkhueler, 2006). A game might include a tough problem but allow for multiple possible solutions (in *Portal*, for example, players can use different objects or a different number of portals to solve the same puzzle; players often spend a tremendous amount of time showing off, arguing about, and searching for more efficient or more outrageous solutions). The game is designed in such a way as to not only allow for these different solutions, but to teach players how to conceive of them in the first place and to place these experiences in relation to previous experience within and beyond the game (through numerous interactions with the game mechanics and rules, through structured sequences of

interactions, and through experiences with space and movement in the "real" world). Even at a surface level it is clear that videogames align well to the designed nature of teaching; like all teaching, games are oriented to some problem and leverage opportunities to design (including both creating and managing) environments to promote some intended action or "knowledge".

A quick case study in design: Warren Spector, *Deus Ex*, and good teaching. Warren Spector, designer of one of the most well-reviewed games ever, *Deus Ex* (the game was named "best PC game ever" by a panel of reviewers for PC Gamer magazine in 2011), developed a set of "Commandments of Game Design" (2013) during the development of the game. Here is what he calls the "mission statement for the game:

1. **Always Show the Goal** - Players should see their next goal (or encounter an intriguing mystery) before they can achieve (or explain) it.
2. **Problems not Puzzles** - It's an obstacle course, not a jigsaw puzzle. Game situations should make logical sense and solutions should never depend on reading the designer's mind.
3. **Multiple solutions** - There should always be more than one way to get past a game obstacle. Always. Whether preplanned (weak!), or natural, growing out of the interaction of player abilities and simulation (better!) never say the words, "This is where the player does X" about a mission or situation within a mission.
4. **No Forced Failure** - Failure isn't fun. Getting knocked unconscious and waking up in a strange place or finding yourself standing over dead bodies while holding a smoking gun can be cool story elements, but situations the player has no chance

to react to are bad. Use forced failure sparingly, to drive the story forward but don't overuse this technique!

5. **It's the Characters, Stupid** - Roleplaying is about interacting with other characters in a variety of ways (not *just* combat… not *just* conversation…). The choice of interaction style should always be the player's, not the designer's.
6. **Players Do; NPCs Watch** - It's no fun to watch an NPC do something cool. If it's a cool thing, let the player do it. If it's a boring or mundane thing, don't even let the player think about it - let an NPC do it.
7. **Games Get Harder, Players Get Smarter** - Make sure game difficulty escalates as players become more accustomed to the interface and more familiar with the game world. Make sure player rewards make players more powerful as the game goes on and becomes more difficult. Never throw players into a situation their skills and smarts make frustratingly difficult to overcome.
8. **Pat Your Player on the Back** - Random rewards drive players onward. Make sure you reward players regularly and frequently, but unpredictably. And make sure the rewards get more impressive as the game goes on and challenges become more difficult.
9. **Think 3D** - An effective 3D level cannot be laid out on graph paper. Paper maps may be a good starting point (though even that's under limited circumstances). A 3D game map must take into account things over the player's head and under the player's feet. If there's no need to look up and down - constantly - make a 2D game!

10. **Think Interconnected** - Maps in a 3D game world feature massive interconnectivity. Tunnels that go direct from Point A to Point B are bad; loops (horizontal and vertical) and areas with multiple entrance and exit points are good." (np., emphasis in original)

This is a remarkable list, not simply because it led to a fantastic game, but because it aligns so closely with the theory of teaching I have already described as well as with the set of good teaching principles I will develop in the next chapter. Spector, for example, recognizes the importance of clarity (the player should know what their goal is and should be able to figure out how to get there through interacting with the system of the game) and of the active, participatory nature of the medium but also of the way that active engagement propels the player forward in learning to succeed in the game. Spector also understands the need for the challenge of the game to continually "ramp up" and just exceed the player's ability (mirroring the ZPD and the theory of Flow). Again, while this is partly due to the nature of the medium (games—especially ones based on skill—must keep a player engaged by continually presenting greater challenges as the player becomes more skilled, i.e. learns how to succeed), it is also an intrinsic feature of both good teaching and deep learning as I've defined it.

Let's look at *Deus Ex* and Spector's commandments more closely in terms of the features of an experience good for learning. The player certainly has some actions to take towards solving the problem (this is, in fact, the essence of gameplay; Spector goes one step further in commandment 6 by stating that players should be allowed to do "cool" things and in commandment 3 that players should have many different actions possible to reach a solution). The player has clear goals and a sense of what to do to reach them (the

game explicitly provides these goals like talking to specific players or getting into various locations, and Spector stresses the importance of goals through commandment 1). Something is at stake for the player, although the extent of their affective involvement varies from player to player; much of what is at stake might simply be ego, or interest in mastering the game, or interest in the story (the game also provides some narrative involvement through the threats to the character; commandment 5 suggests the player invests some of their own goals and interest by choosing how to interact with the game, and commandment 8 suggests ways to reward and motivate players). The experience is constrained so the learner avoids cognitive overload (like many games, *Deus Ex* builds on some kind of linear progression where new skills, weapons, and features are "unlocked" as the player progresses; commandment 7 also hints at the way the game grows as player's become more competent). Lastly, players can plug in to other tools in the guise of the game itself (the game "knows" how to shoot or open a door, for example so players can focus on other learning tasks; Spector doesn't necessarily directly address this but the overall tenor of the commandments and the nature of interactive media like a videogame dictate the connected and distributed nature of play [see also Holmes, 2015, for more]).

We can do the same exercise for the design features of *Deus Ex*. The game is organized to foreground and background information (things like interface elements, dialog boxes, and the overall structure of levels do this; commandment 2 refers to the way designers should make the pertinent information clear and logical). The game also provides plenty of opportunities to develop patterns (manipulating objects and dodging security guards repeat and vary throughout the game, so the player can develop expectations and anticipate future interactions; commandment 7 again suggests that

players quickly learn the patterns of the game and must be continuously challenged by altering or subverting these patterns). The game provides a challenge that is non-trivial, interesting, and useful (*Deus Ex* is often called a difficult game, and it takes a great deal of skill to perform well, while also providing a narrative arc that is compelling and engaging; commandment 4 suggests that players should only experience failure through their own effort and not through arbitrary design whims, while commandment 3 suggests that players have freedom to try out solutions and tackle challenges in interesting or novel ways). As previously stated, the game provides clear goals and also assesses the player's progress (the player must complete tasks to proceed to the next level, a clear measure of their successful mastery of the challenge at hand; no one command explicitly references this feature, though once again the nature of games dictates plenty of assessment of players participation and performance). Finally, the game offers plenty of feedback to the player (getting shot, for example, provides visible and aural feedback, and often players are explicitly told not to kill or play aggressively; commandment 8 at least tacitly refers to ways of providing feedback to players in the form of rewards). Both of these lists are quite simplified and only gloss over these various features, but both lists should serve to highlight the ways the design of *Deus Ex* and the experience of playing it support and model good teaching, and especially good teaching that aligns to strong theories of how the mind works.

I find it especially interesting how closely these commandments anticipate the principles of good teaching I derive from Hattie in the next chapter; comparing this list to those principles reveals a great deal of similarity. Spector anticipates many of the best features of teaching without ever explicitly recognizing them as such. Even more

interesting is that Spector developed these commandments in 1997, nearly 20 years before Hattie's work. That a game designer can so clearly and closely articulate good teaching principles as part of their design process is, to me, telling of the nature of game design and its relationship to teaching over all. It is also, in light of my broader argument about the need to more explicitly connect the two, quite powerful evidence of the kinds of things teaching can learn from game design.

Teaching as a Design Act

This chapter was intended to highlight the ways that teaching is a form of design which leverages the ways the human mind learns through patterns of experience, and how learning is founded on socially constructed and shared features. It is also meant to preview the various actions used in *actually* teaching. But I also want to stress that design itself is a kind of act; it is not separate from the other teaching acts I will define in the next chapter. Although I have afforded it special status by dedicating this entire chapter, the act of designing experiences good for learning and actually enacting those designs are interrelated. Design is the "primordial" teaching act, the act which dictates how the other acts are used. That said, the act of design is only part of teaching. Within the design, a teacher engages in the other acts I will now turn my attention to (showing, telling, motivating, orchestrating participation, managing attention, assessing, and providing feedback).

This chapter was also meant to explicate the relationship between designing as a teaching act and the design of videogames. Game designers have intuitively "caught on" to many fundamental principles of good teaching, and the methods that game designers

use to promote and sustain engagement, model action, and tell the player how they are doing in their participation can be quite illuminating when considering teaching of all kinds. Lastly, I have attempted to demonstrate that videogames can teach and that game designers are, in many ways, teachers in their own right. I will continue this theme in the coming chapters, but here I want to emphasize the nature of design (both in videogames as well as all forms of teaching) as a way of organizing and optimizing the conditions for uptake.

CHAPTER 4

VIDEOGAMES, TEACHING ACTS, AND GOOD TEACHING

The previous chapter argued that teaching begins with the act of designing experiences that are good for learning. These designs help to make learning efficient by optimizing the conditions for uptake, including providing clear goals, constraining the experience to prevent cognitive overload, providing opportunities for the learner to take some action towards solving the problem, promoting affective involvement, and helping the learner to network with other tools and minds. But these designs are only part of the overall act of teaching. Within these designed experiences the teacher engages in various acts or ensures that they happen through peers, tools, or aspects of curricular design. This chapter is dedicated to defining these acts and operationalizing teaching in order to look for specific instances of teaching across a range of sites (including videogames).

There is another important reason why I have separated the design of a teaching event from actually enacting it. I want to emphasize that teachers aren't *just* orchestrators or designers (though they certainly are these, too). Instead, teaching is also a procedural act, and teachers are, in a sense, "in" the experience with the learner. That is, the teacher *designs* the experience but is also a *part* of the experience. This applies to traditional notions of teaching (say, a classroom teacher giving a lecture) as well as tools or media that also teach (a videogame is an "enacted design" where the player interacts with not just the media of the game, the sights and sounds and mechanics, but with the people who designed it as well). My point here—and a key way of understanding the current chapter—is that teaching is an active process and that teachers are *co-participants* in the learning experience.

In the previous chapter I previewed these teaching acts (showing, telling, motivating, orchestrating participation, managing attention, assessing, and providing feedback). I wish here to flesh these acts out by demonstrating how they work both in traditional notions of teaching (like in the classroom) as well as in informal spaces like videogames. My intent here is to stress that these teaching acts occur in all kinds of spaces, and that using these various teaching acts as metrics, it's possible to consider many different events, led by many different kinds of people, as forms of teaching. In other words, these acts provide us with a way of gauging if and how an event is an example of teaching.

Further, with the understanding of the role of designing experiences that are good for learning and the way deep learning (uptake) occurs, coupled with these operationalized teaching acts, and using Hattie's Visible Learning meta-meta-analysis which provides an empirical basis for features of effective teaching, I believe we can go one step further and establish a set of principles of "good" teaching. I also believe that "good" videogames clearly demonstrate these principles, so I will use examples from a range of games to show how these principles manifest. The overall goal, then, is to suggest that videogames not only demonstrate these principles of good teaching but can act as guides or models for teaching design and acts of teaching wherever it occurs.

Teaching Acts and Teaching Events

First I want to explore the *act* of teaching, or what kinds of actions go into making a *teaching event*. By teaching event, I mean some situation which uses combinations of the teaching acts defined below to create the *conditions* for uptake. In later chapters

(especially Chapter 6) I will argue that teaching is actually a network of these teaching events, and learning is a path or trajectory across many such events. However, here I want to limit it to a single event so as to isolate the various acts. That is not to say that only one of the teaching acts can occur in any given teaching event; indeed, I want to stress here that these acts are related and happen at different levels, often simultaneously, and it is this co-occurrence which makes the situation a teaching event.

Take, for instance, a parent teaching a child to ride a bicycle. The parent begins with a number of design decisions (whether they will go to a park or the street to practice, what kinds of equipment they will use, whether they will hold the handlebars for the child, what kinds of words and demonstrations they will use). When it comes time to actually engage with the child, they may provide some motivation to the child (by encouraging them or reinforcing them, by displaying enthusiasm, or by telling the child that they can ride along with the rest of the family, for example). They will tell the child what to do (how and when to pedal, how to use the brakes), and may show them (by riding their own bike in front of them, or riding alongside). They will encourage the child's participation in the event (the child has to actually try riding the bike). They will attempt to constrain the experience in some manner and not provide too much information and overwhelm the child (they don't need to know about gravity, for instance, at this particular point). They will certainly try assessing whether the child is successfully riding, not the least of which is to know that the child won't be hurt. And they may try providing feedback, whether in the form of encouragement or corrective actions. All of these acts work together to make up this teaching event; the design organizes the ways the parent shows and tells the child various things, which in turn leads

to assessment on the effectiveness of their instruction, which might alter how they provide feedback and show an alternative method, which changes the design of follow-up teaching events, and so on.

Furthermore, the child may not learn successfully after the first attempt, or even after several attempts, and the parent may need to try again later. This is the conundrum of learning (it can take time and repeated failure before actual learning occurs), and one reason why I seek to distinguish between teaching events (some instance of combinations of teaching acts working towards some specific learning goal) and, later, networks of teaching events (which might more adequately "explain" learning). This distinction is meant to deal with teaching as a process independent of learning (such that it is possible) and to try to theorize just what makes something an instance of teaching. By defining an instance of teaching as a teaching event, it is possible to look at this process and avoid the complexity of the learning pathways more accurately represented in the networked/collective model I will later describe.

These teaching acts are also the way the designed experience is enacted; the design of the teaching event is meant to optimize the conditions for uptake, and the acts are the ways the teacher makes the design "happen." In other words, design organizes *how* the teaching acts will be used, and the teaching event is the experience that the design creates.

Motivating. Motivating can refer to some kind of extrinsic force (say, a grade or the way grades are tied to "progression" through school, or the way a parent might tie a child's grades to their allowance). But at a deeper level,

teaching is about activating some kind of intrinsic motivation, some internal factor that leads to continued interactions, practice, and mastery (Deci and Ryan, 1995). Teaching—and especially the kinds of deep teaching I am interested in here—does this latter function by creating opportunities to "try on," work with, and ultimately adopt some identity. In Chapter 7, I will discuss the intrinsically motivated nature of a *deliberate learner* and the ways teaching builds this kind of identity. For now, I am suggesting that teaching motivates a learner to engage with the task at hand, persist past failure, and to recognize the value of their learning.

This motivation can take many forms, even in school. Grades are a controversial motivating factor (Alderman, 2013), though there are certainly other forms of motivation possible which can recruit intrinsic engagement and participation. A history teacher might assign their class to role play as various historical figures or groups, and require them to research their roles and prepare some kind of script or performance. Some (though likely not all) students may relish being given a choice or have some interest in one particular group; others (though maybe not the same ones) may appreciate the chance to create their own stories or characters and the creative freedom of the exercise; still others may look forward to a chance to lead their group or provide the costumes or write the dialogue or act in front of others or simply to break up the monotony of other class assignments. Whatever their interests, such a design can motivate them in certain ways in order to keep them engaged and participating (and learning).

Games certainly provide strong motivating features. These might include the narrative (players must solve a murder in *L.A. Noire* or face off with a deranged megalomaniac in *BioShock Infinite*) and the identities they can take on (they are the savior of the galaxy in *Mass Effect* or a lowly soldier in *Spec Ops: The Line*). These motivations may also arise from the mechanics of the game (the endless replayability of *Tetris* or the frantic action of *StarCraft*) or even the overall experience of the game (the relaxing body-screen connection of *Flower* or the intense competition of *League of Legends*). These are ways of keeping the player playing, but also of helping them to care enough to take the time and effort to learn to play the game well.

Telling. Telling refers to informing through rich language and other sorts of symbolic information and is usually overt and explicit. Telling is, along with showing, the most "visible" teaching act. Telling is also, perhaps, the act most closely identified with traditional notions of teaching. Telling includes any kind of direct or even indirect instruction. These could be directions (how to build a model rocket) or suggestions (holding a tennis racquet in a certain grip). Telling also includes more abstract things like how to deal with a bully or why segregation is a bad thing. Telling does not have to only be about facts, but is also related to the kind of motivating identity-building described above.

Telling, of course, has a long history with school-like teaching, and extends even to the roots of human social interactions (Tomasello, 2014). Telling is also the least reliant on any technology greater than language, and so is a

"natural" human action. What separates something from being *simply* an act of telling (such as telling someone the time) and telling as a teaching act is how it fits into and supports the design of the learning event. A simple utterance or factual statement may serve some functional purpose (helping someone know what time a bus arrives, or warning them when they are about to get hit by a runaway shopping cart) but it never connects to some broader purpose (such as building an identity, or knowing how to apply some knowledge abstractly). And not all statements or conversations are intentionally organized to teach (a car salesman may not want you to understand the financing details in order to maximize their own profit), though it is certainly possible to learn a great deal from this kind of interaction (learning, say, that you should come to the car dealership with details on cost and interest fees in advance, although unfortunately this learning may come too late). Telling, in order to be a teaching act, must be in the service of some kind of designed, intended, transformational transaction.

A lecture is a common example of telling in school-like teaching. For a number of reasons, lecturing has earned a bad reputation in most contemporary discussions about teaching. Some of these are supported by evidence; lecturing *by itself* is demonstrably a rather ineffective teaching strategy (Freeman et al., 2014). Others criticisms are based more on an ideological predisposition against teaching though telling (that teachers "indoctrinate" or "colonize" students, for example [Apple, 1988]). But lecturing can be useful, and there are times that direct instruction is extremely beneficial (especially in very novice learners) (Hattie,

2009). Lecturing can also provide a kind of simultaneous indirect instruction, too; a good lecture can demonstrate an expert in action and set a kind of normative example of what an expert "looks like." For example, a math professor might walk a class through a problem or "worked example" (Gee, 2010). They might explain how to transpose some quantity or what function some variable has, and how they derived their final answer. The teacher has "told" the students some "facts" about their process and the properties of the equation. But they have also "told" things of a different nature: *how* a mathematician speaks, what kinds of words and phrases they use but also what kinds of values they hold and how they express them as well. In some ways, what they are saying and what they are telling are two different (but interrelated) things, both working (ideally) towards some common teaching goal.

In videogames, telling is perhaps a lesser used teaching act compared to showing, at least partly because games are often highly visual mediums and that much of the learning that happens in games happens through players' interactions with the "play" of the game itself. Regardless, games do use telling in many different ways. These might include things that look a lot like telling in school. Early in *Civilization V* directions for how to build cities or place units appear in a small pop up box with instructions on manipulating the interface as well as some conceptual information (like why a location for a city might be good or why an attack might fail). Telling in this sense is somewhat akin to "direct instruction". Games also infuse a lot of indirect telling in ways similar to the description of the math teacher above. *Battlefield 4* contains a lot of telling in terms of *how* a Marine

talks and acts (things like terminology, phrases, and formal language as well as things like obeying a chain of command and operating as a cohesive strike team).

Showing. Showing refers to modeling, demonstrating, or illuminating something, especially through images and visually rich representations. Showing is closely related to telling, and often (but not always) happens alongside moments of telling. Showing, like telling, can include directions (showing how to assemble a piece of furniture step-by-step) or demonstrations of some concept in action (dropping a bowling ball and a feather to demonstrate the concepts of gravity and friction). Showing may also, like telling, act in the sense of showing *how* an expert acts and demonstrate a model of how to behave (a master painter setting up her palate and brushes). Showing can be direct, but it can also be subtle or implied; a savvy learner can pick up on unspoken (and even unintended) cues.

In school-like teaching, showing often manifests as the demonstration model, where a teacher might work step-by-step through a problem. The math example above fits with showing as much with telling (and demonstrates the interconnectedness of these two acts); the teacher may write the problem on the board and mark up the equation, change or erase variables, and repeat the process in several different ways to highlight alternative solutions or steps. A music teacher might "show" students how a particular passage sounds by playing it an instrument; they might show their hand placement, but they are also "showing" the sound, tempo, tone and so on. Showing is not only about visual cues but about *demonstrating* some act or state.

Showing is a common technique used in videogames. Showing can be explicit here, as well. *Madden 15*, for example, features training and practice modes which shows the route a wide receiver will run in a diagram or graphic, then show the receiver *actually* running the route and catching the ball on the field, and then let the player practice at it repeatedly. Showing can also be used to highlight important parts of the interface or game world to pay attention to and to make certain features or information salient to the player. *Crackdown* uses several methods of showing the player important features of a mission, from centering the camera on some object or building, visibly highlighting key elements with a colored marker, and even "previewing" the upcoming action the player is likely to encounter. These are examples of explicit showing in videogames.

Showing also works in the same sense as telling in that it can be used to build the world and the contexts for a player's actions (and learning). A game like *Fallout 3* uses visual cues about the world (a barren apocalyptic wasteland) to create the frame for a player's experience. The types of objects, the landscape, and the overall aesthetics are ways of showing *what kind* of world it is, *what kind* of person they are, *what kind* of actions they might take, and *what they might mean* in that world.

Managing Attentional Economy. Physiologically, the human mind can only process a certain amount of information at a given moment. This is commonly referred to as "cognitive load" (Sweller, 1988). We must choose how and where to apply this limited processing. A leaner may struggle in deciding the

best way to apply this "attentional economy," so teaching helps learners manage their attention. Teaching focuses a learner towards some feature or element and emphasizes why it might be worth paying attention to while minimizing other superfluous or confusing elements. In this way, good teaching helps to condition the learner on *how* and *why* to spend their time focusing, reducing the potential for distractions or chasing "false" leads as well as priming the learner to continue this attentional economy management on their own.

School typically handles this management through a variety of means. One is by setting up "subject areas" (history, math, English) and courses within a subject (History of Gender Politics, Calculus, The American Novel). These are means of framing a perspective or declaring what is important in the curriculum (looking at sequence and change, numeracy, communication and expression). It is perhaps not surprising that many things in the world can be looked at from many points of view, and subjects (or disciplines) exist in part to break down the complexity of the world into discrete or manageable parts. School also handles attentional management through things like the setup of a physical space (a large lecture hall, rows of desks facing forward, a laboratory, chairs arranged in a circle, posters on the wall, outdoor classrooms) and the social space (cohorts of students, grade levels, class time versus after-school time). These are often institutional features of management (the brick-and-mortar solutions).

School-like instruction also breaks up information to help learners manage their attentional economy. Courses are often taught in a progressive order (from arithmetic to algebra to calculus in math, for example). Lessons, too, are often

ordered in this way (teaching an introduction to economics might include discussing supply-and-demand theory, then moving to issues of production and distribution, then to patterns of consumption and wealth distribution, and so on). One reason for this is to introduce broad concepts and then progress to more specific (or complicated) issues. Ideally this reduces introducing or encountering potentially confusing material before a learner is ready for it (they need to understand the number line before doing logarithmic calculations, for example). However, it also risks breaking the flow of specific/concrete to general/abstract organization necessary for good learning described above.

Videogames also often sequence experiences from "simple" to "complex." A new player in *Star Trek Online* has access to only a few basic commands on their character, and the game gradually introduces new abilities as well as more complex types of interactions (ship-to-ship combat and crew training, for example). These experiences are designed to introduce the "basics" like character movement and interface management and then "leveling up" to greater complexity. These experiences limit extraneous information early (like skill trees and advanced tactics) to help manage the kinds of things the learner might pay attention to. Good games also provide a strong correlation between these initial experiences as specific cases and then creating plenty of opportunities through iteration to build general models for things like combat, inventory management, and so on.

As digital media, videogames also have a number of ways of displaying information multimodally. In *Halo*, the interface "grows" as the player encounters

new actions and abilities; each time a new feature (like the player's health) is "added," the interface explicitly highlights it and calls attention to itself. This interface is designed to provide the basic information relevant to a player without overwhelming them with information they don't need yet (they don't need a health bar since they aren't yet in danger of losing any health so the game does not "clutter up" the interface with unnecessary information). These are aesthetic methods of managing the amount of processing necessary as well as focusing the player's attention on specific information. It helps them build models for when and why that information (like health) might be useful.

Orchestrating Participation. One key feature of learning that I have stressed throughout this dissertation is that it is an active process and that learners must do some work. Teaching, therefore, must provide a way for students to participate and engage in the act of learning. One way of doing this is through orchestrating opportunities or ways to participate, from talking to actively manipulating objects or themselves to interacting with others. But this participation must be meaningful in some way and must align with the learning task at hand. If the teaching event is designed to teach about how to shoot a basketball properly, it is not very useful if the learner is cataloging all of the colors of the other players' shoes. In other words, the participation must be the right kind and must have something to do directly with the task at hand. Of course, learners will likely not know if they are participating in the right way or

what exactly is meaningful about their participation—it is the job of the teacher to help them recognize these moments.

In school, orchestrating participation can take several forms. One common form is through class discussion or through asking students questions and engaging with their responses. Indeed, there is a growing movement known as Accountable Talk (Michaels, O'Connor, and Resnick, 2002) that advocates for this kind of content-appropriate dialogue. A teacher can gauge the level of engagement and the student's general alignment with the learning goals through their participation. Another form, of course, is through things like tests. Tests are a form of assessment, as I'll describe below, but they are also ways for students to engage with the course content and to participate in the procedures of the class itself (whether this is a good form of participation or not I will ignore for now).

Indeed, one of the primary criticisms of the contemporary classroom, and one of the claims that fuels so much interest in informal learning settings as I've already suggested, is that students often lack viable or meaningful ways to participate in the learning experience. This is a controversial topic, and undoubtedly there are many classrooms and many teachers who create a great deal of opportunities to participate. More generally, these criticisms point to the strong role active participation plays in deep learning and, in fact, the inherent need of the mind to engage with problems in active and meaningful ways.

Videogames are primarily spaces for participation (despite some criticisms about the exact nature of interaction in games). Generally speaking, games *require* active participation from the player in order to enact the design of the

game. Games do this in many different ways. The most basic way is through some kind of input scheme (a controller, an interface) where players control their characters or manipulate menus. A player playing *Wii Sports*, for example, uses a controller strapped to their hand to mimic motions like hitting a tennis ball or bowling; the game provides several instructions to the player on how to use this controller, but a great deal of it is gleaned through actively using the controller and getting a sense of the connection between their in-person/embodied movements and their on-screen actions. Further, players must perform these actions relatively "true" to their real-world correlates; a player can't bounce their controller and expect to successfully bowl. They must use the controller in the "right kind" of way.

Another form of orchestrating (the right kind) of participation in games is through the mechanics or rules of the system. A player of *The Banner Saga* not only moves their on-screen characters around the battle grid but must strategically balance attack and defense, types of damage, their own health and the health of their enemies, the victory conditions and so on. In order to succeed, they must manipulate these variables in a particular way (the game allows some leeway at the risk of alienating too many players; other games, like *Super Meat Boy* are far less forgiving). The game offers plenty of opportunities to try out various tactics and to iterate on their participation.

Interestingly, many games rely increasingly on participation outside of the game "proper" in affinity spaces such as websites or through peer interactions (Gee and Hayes, 2010; Hayes and Duncan, 2012). This is a theme I will return to

more fully in Chapter 6, but for now I want to highlight the ways that participation does not end just at the boundary of the game but can extend across a great number of sites. Videogames demonstrate very clearly the networked nature of this kind of participation, but they also highlight some of the limitations of the game as a teacher; not all participation necessary for real mastery is possible within some games and players must actively seek out outside resources to fully participate. For example, high-end performance in a game like *World of Warcraft* relies on a great deal of "theory-crafting" that occurs on separate websites and uses special custom-made tools like damage meters in order to allow players to debate and modify various theories about how to maximize their performance. This does not occur directly in the game, but around the game and feeds back into the game.

Assessing. I use "assessing" here in a broad sense; I mean it as a means of observing and establishing where a learner is, what they need to know, and whether the teaching acts are effective. Assessing where a learner is (what they know already) helps the teacher understand what the learner needs to know next to get to some goal and to determine what things they should teach in what way. Assessing is then about determining if those teaching choices are effective (whether the learner is actually learning), and planning any changes to the teaching acts or content. Assessing is reflexive and as much about the teaching as it is the learning, as Hattie argues.

Assessing in schools is often closely associated with *testing*. The notion of testing is a political landmine (at least, in the contemporary American public school setting) which I will mostly avoid here. Testing, at its broadest, often assesses a learner's knowledge of facts (say, a multiplication table test in mathematics), though it can also test for skills (a pull-up test in gym) or application of "factual" or procedural knowledge (an interpretive essay). Tests are arguably intended to assess those things I indicated above (what a student knows, whether they have learned through the teaching interventions) and arguably used to alter teaching itself, though much heated discussion exists around the actual uses and purposes of testing.

Videogames often include assessment as a core part of their design and of gameplay. Many videogames assess the player's skill or proficiency and can alter the game based on these assessments. *Call of Duty: Modern Warfare*, for example, includes an introductory mission where the player must shoot targets using different weapons and complete an obstacle course. By measuring these various proficiencies (accuracy, speed) the game suggests a difficulty level to the player, which alters how accurate enemies will be, how much ammunition and other weaponry will be available, and so on. Assessment in videogames can also be used as a kind of gatekeeper, where the player cannot progress without demonstrating some skill or knowledge. A player must use their portal gun quickly to escape a certain death at one point near the end of *Portal*; here the game is assessing whether the player has learned how and when to use their portal gun in the right way, and if they cannot they will fail. Often assessments in games

are hidden, or at least so deeply enmeshed with the other features of gameplay that they do not explicitly stand out as assessments (see especially Shute and Ventura, 2013).

It is also important to note that most (commercial) videogames are the result of hundreds of iterative design revisions which have been modified repeatedly based on player interactions (often referred to in the industry as *playtesting*). In part, this playtesting highlights "breaks," "bugs" or other failures on the part of the designers to help the player learn, use, and master the mechanics of the game. Assessment in games in this form is a kind of *self-assessment* as a corrective method in order to address failures to teach through the game design.

Feedback. As Hattie notes, feedback comes in different varieties, and some is more effective than others. Feedback from the teacher to the student can address four different levels: *task level, process level, self-regulation level*, and *self level.* Traditionally, feedback is aimed at the task or processes level in the form of corrective actions (pointing out what they did wrong and how to try a different approach) and is often ignored or not understood by a learner. Feedback that addresses "where to next" (as described in the next principle) is far more likely to produce significant achievement gains, especially as it relates to the learners own perceptions of their learning (the self-regulation level) and how it fits into their identity (the self level). Good teaching addresses all of these levels as well with feedback that points to what the learner needs to do next and why it matters.

Hattie's Visible Learning and Good Teaching Principles

Now that we have covered the role of design and the nature of good learning in the previous chapter, and operationalized teaching in the current chapter, we can build a set of principles that describe what makes something an example of "good" teaching. Indeed, not all teaching is equal and not all teaching supports the conditions for uptake effectively. Instead, I argue that "good" teaching respects empirically observable features that "work" in teaching (and learning). I wish now to argue that teaching events and teaching acts that honor this evidence are most likely to support uptake.

In particular, I base much of this theory of good teaching on Hattie's remarkable work on Visible Learning (2009; 2012; Hattie and Yates, 2014). Hattie's theory of Visible Learning is based on a meta-meta-analysis of over 900 meta-analyses of studies on learning across a range of factors. Perhaps the most insightful finding of this work is that virtually all teaching interventions "work," but there is a threshold which separates just *any* teaching with *effective* teaching (what I have been calling "good" teaching). Teaching that exceeds this threshold is demonstrably effective in producing meaningful learning outcomes. This has (at least) two significant implications. The first is that teachers themselves matter and that there is a role for instruction in learning, and in particular a role for good teaching in producing good learning opportunities. The second is that it is possible to create teaching interventions based on evidence of effectiveness and not ideologically-motivated assumptions. I highlighted some of these assumptions in the previous chapter. For the present discussion, I want to simply argue that Hattie's work strongly supports the potential for developing a robust theory of teaching that leverages

"facts" about effective teaching. This dissertation is intended to be one step in that direction.

Furthermore, I believe that Hattie's research suggests that it is fundamentally possible to develop a "science" of teaching just as we've developed a "science" of learning. Let me be very clear in how I am using the term "science." There is certainly a centuries-old debate about the nature of and the relationship between the science of teaching and the art of teaching. More contemporary views of teaching often seek to stress a middle ground of sorts, a recognition that there is a need for both a practice and a theory of practice around teaching; even groups like the Bill & Melinda Gates Foundation have stressed the "art and science of teaching" (Gates, 2013). The issue is complicated by the way, particularly in America, science is often associated solely with "hard sciences" and the "science" of teaching might evoke the specter of Skinnerian behaviorism. I use the term "science" as the accumulation of empirically-derived facts. This is not the only meaning of science, for sure, since science is also a *practice* (Gee, 2010). However, here I wish to us the phrase "the science of teaching" to mean that it is possible to gather evidence (which has been demonstrated and could likely be repeated given similar circumstances) about what is effective in teaching that promotes deep learning to build a theory of teaching. This theory then drives the "lived" practice—based on evidence—of teaching.

The good teaching principles I outline below are adapted from Hattie rather than direct conclusions presented in his Visible Learning work. Many of Hattie's findings about learning address teaching explicitly, and his *Visible Learning for Teachers* (2013) is directed at teachers specifically. However, I find that the principles about teaching that

Hattie himself provides are inadequate for the current discussion (for one thing, *Visible Learning for Teachers* is focused on *classroom* teachers almost exclusively, and provides advice and findings based on school-based teaching). Most of Hattie's source meta-analyses are similarly based on classroom-centered teaching. In part I have re-arranged and modified Hattie's findings to overcome this school-based focus and draw a broader theory about teaching wherever it happens while remaining true to the evidence of Hattie's general conclusions.

In relation to games more directly, Gee (2003) demonstrated 36 different principles of good learning found in games (as I discussed in the previous chapter). It is tempting to suggest that these principles can simply be translated into teaching (design) goals; so that, for example, Gee's *Psychosocial Moratorium principle* can be restated as "creating opportunities to fail safely is a principle of good teaching". While there is a great deal of truth to such a statement and a great deal of utility in such a move, I believe it does not adequately cover the functions of good teaching as it relates to good learning. Certainly there is considerable overlap with Gee's principles and the good teaching principles I adopt from Hattie's work, if not a direct translation. Instead, I will show how games can align to Hattie's evidence-based conclusions *specifically* as teaching interventions.

Learners perspective principle. Good teaching begins with an understanding of what a learner needs to know, where they lack information or previous experience, and how they "feel" about the learning at hand. As Hattie suggests, learners must feel that they *can* successfully bridge the gap between

what they already know and can do and what they are about to learn (see also Willingham, 2010). Further, Hattie argues that expertise often clouds the view of a teacher, who may forget what it's like to be new to some topic or field and may "chunk" information that a novice needs explicated. Teaching from a learner's perspective means designing teaching events that attend not just to the knowledge a learner must gain but also to their experience encountering such an event as a new learner.

> *Game example:* Civilization V *includes a tutorial section for new players which introduces basic elements of the game (like construction of buildings and units, and basic combat). The game includes a wide range of possible actions, but new players cannot benefit from these features at the start but only through "progressing" in the game (for instance, switching between government policies), so the designers have excluded these from the introductory portion of the game that new players first encounter.*

Clear goals principle. Good teaching makes the goals of the activity, and how they tie into the larger learning contexts, clear to the learner. This is, in many ways, the essence of Hattie's conception of Visible Learning (and Visible Teaching): that the learner knows what is expected of them, what kinds of support they will have, and what it looks like when they succeed. Furthermore, humans are fundamentally goal-oriented beings; it is a core organizing principle of how we perceive the world. Good teaching captures our need for goals to fit actions or

information into our lived experiences. Having a clear understanding of some goal gives a learner a sense of where they are going, how they are doing, and a way to know when they have arrived. It also provides a reason to care about the activity as it aligns to some present or future use.

> *Game example: In the* Assassin's Creed *tutorial, players are introduced to new skills sequentially. The tutorial takes place in a completely blank space, with only the player's character and the objective visible (climbing some object, sneaking behind other characters, etc.). Very little superfluous information is present, so the objective is very clear and their success or failure is readily apparent.*

Challenge principle. One especially important finding from Hattie's work is the function of difficulty in relation to learning. Hattie suggests that setting difficult goals has a direct effect on higher achievement compared to easier or undefined goals—provided they are paired with good support (feedback, practice, etc.). This may seem counterintuitive, and many conceptions of teaching hold that we should make learning as easy as possible. Certainly it is true that teaching should remove *unnecessary* barriers (confusing language, unrealistic time frames, and so on), but this is not the same as reducing challenge. Instead, Hattie has found that the challenge should be non-trivial and should be just beyond what the learner can already do without seeming unachievable. Good teaching helps to bridge this gap (a concept closely aligned with Vygotsky's Zone of Proximal Development [1933]). Further, difficult tasks force the learner to focus on the task

at hand, increasing the likelihood that they will pay attention to the right kinds of things and that they will respond to feedback about their performance.

> *Game example: Early battles in* Star Wars: Commander *pit the player against significantly superior forces. Players are given access, however, to special improved units that they can't yet use once they have completed these tutorial levels. This presents a difficult challenge but one that can be solved with the "support" of the game. Players are also oriented towards future actions.*

Connecting experiences principle. Humans learn through experience, but they must be able to connect these new encounters with previous experience. Hattie argues that learning only really happens when the learner can "bridge" the gap of what they know with what they are expected to learn, so good teaching must help connect them. Good teaching can organize or structure experiences in such a way to ensure that the learner experiences things in the right way at the right time. Good teaching can also make explicit the previous knowledge a learner has and how it fits with the learning at hand. Good teaching serves two functions here: to *create* experiences and to *relate* those experiences to one another.

> *Game example:* Thomas Was Alone *features seven different characters (tools) with unique properties that the player uses to solve many different puzzles. The game is organized so that the player encounters each character individually, and gradually has opportunities to combine their different attributes as puzzles become more complex. The game organizes*

how and when the player experiences these properties and (through the overall design of the puzzles) shows how to coordinate them.

Developing strategies principle. Part of the difficulty learners might experience when encountering new material is in knowing *how* to approach the problem (how to identify it, to break it into manageable portions, or to pay attention to or ignore parts). Good teaching helps learners develop strategies that are adaptable to new learning events. These strategies are not rigid schema but instead are networks of previous experiences, prior instruction, and practice. Good teaching provides insight into how to structure these experiences in order to recognize and process new (even novel) information more effectively. Experts, as Hattie points out, can "chunk" large amounts of information and can conceive of the information both as a unified whole and as discrete units. They do so through effective strategies for handling new information. Good teaching helps learners develop these kinds of strategies.

Game example: In Dragonbox*, players progress through a series of increasingly complex problems based on balancing two sides of an equation. The game begins with simple iconographic "cards" that the player must remove from both sides, and eventually evolves to replace the iconographic cards with mathematical symbols. The player has encountered simplified versions of later problems, and has had many opportunities to recognize and manipulate the math concepts in a different form (pictures instead of variables). They should be able to "read" the*

problem as a particular "type" and have developed a strategy that can handle it.

Timing principle. Teaching is often about timing; giving a learner some information too early will generally make it meaningless, and giving it to them too late will generally render it useless. Good teaching provides the *right kind* of information at the *right time* to the learner. This information can come when a learner needs it (just-in-time). It can also be available when a learner wants it (on-demand). Lastly, it can be provided as potentially useful information (just-in-case). Part of good teaching is about organizing the teaching event to provide this information in the right way, but also about helping the learner know when to call on this information themselves.

Game example: Deus Ex: Human Revolution *includes a feature where players can selectively upgrade their character through cybernetic "augmentations." This feature is unlocked several missions into the game and is not immediately available. Once players unlock it, the game shows a short demonstration video and opens the augmentation interface (just-in-time). The game provides textual information about the augmentations (including background information on the underlying technology and its history) (just-in-case), and players can access the video and text at any time afterwards (on-demand).*

Opportunities for deliberate practice principle. Hattie makes an important distinction between *kinds* of practice. One kind is rote practice in which the learner just engages in "repetitive learning". The other kind is *deliberate practice* where the learner consciously strives for improved achievement. This deliberative practice is far more effective in deep learning, overlearning, mastery, and ultimately self-teaching. Good teaching creates plenty of opportunities for the learner to engage in deliberative practice coupled with effective and timely feedback.

> *Game example: Throughout* Portal*, players use skills they've just learned (how to place the portal, the "double jump", etc.) to solve puzzles. They also use these skills in subsequent puzzles, usually in conjunction with additional skills they learn. The game also includes special "challenge modes" which reward players for fewest portals used or least steps taken. Players have plenty of opportunities to practice these skills in order to tackle these special (and difficult) challenges.*

Feedback both ways principle. Feedback is one of the key things a teacher gives to a learner, but feedback *to* the teacher is arguably even more important. Feedback to the teacher points to the efficacy of their own teaching and how they might need to adjust it to encourage learning. This feedback can come from critically observing their own teaching practices, feedback from the students (through assessment of student performance but also through dialogue about the student's perceptions), and interactions with other teachers.

Game example: Most games have gone through significant testing before being commercially released so examples of player feedback to the designers is often hidden. One clear place where this occurs is through iterative design where game makers solicit feedback through forums or website and then update the game based on player performance and player input; a "living" game like World of Warcraft *patches the game regularly based on this feedback to the designers.*

Where to next principle. This principle ties the act of assessment with the use of feedback (especially in terms of feedback as part of goal setting). It is a way of recognizing where the learner is currently (what they know, what they can do) and identifying what they need next to reach the learning goal. In particular, Hattie suggests that feedback is most effective if it establishes "where to next" for both the learner *and* the teacher. For the learner, "where to next" helps them focus on the learning task and on their ongoing progress. For the teacher, "where to next" helps organize further teaching acts, setting and revising goals, and understanding how their teaching is working. Good teaching balances the need to know how the learner is doing with the need to know how they need to teach towards the learning goals.

Game example: In Skyrim*, the game is "open ended" in that players can explore and progress at their own pace. To propel the player to the next important task (especially early in the game), the game places map*

markers that indicate important or useful places for interaction and continued progression.

Caring principle. Several related features of the teacher's attitude about their students and their own teaching produce among the biggest effect sizes in Hattie's meta-meta-analysis. These include teacher credibility (0.90), teacher clarity (0.75), and teacher-student relationships (0.72). Hattie labels these and other features as parts of "passionate" teaching, and recognizes that the term itself can often make a teacher somehow less professional. He also suggests that good teachers believe that *all* students can learn. In short, the Caring Principle is about trust, both of the teacher by the student and of the student by the teacher. I have grouped these various features together under the phrase "caring" to suggest that good teaching is designed and delivered by teachers who care about their student's learning and about the efficacy of their own teaching practice.

Game example: The Sims *is fundamentally about unleashing the player's creativity in creating and developing their in-game characters. The game provides a number of creative tools and modes for players and progresses as the player creates and interacts with the world. It lets players co-create the world and experience of the game in a very deep and meaningful way.*

Videogames and Good Teaching

Videogame design—the choices designers make, the systems they create, and the ways they are presented to players—model teaching well through the use of specific

teaching acts. Good videogames also show what good teaching looks like by honoring the principles Hattie identified. The ways videogames teach tell us something interesting about teaching itself: that teaching is a way of designing learning events which motivate learners, show and tell them what they need, orchestrate their participation, constrain the experience in some way, assess both the learning that happens and their own teaching practice, and provide feedback to the learner and to themselves as teachers as well. Videogames don't just provide some evidence that they teach, but demonstrate how to teach especially well.

Defining teaching events through teaching acts opens up ways of considering tools (like videogames) as teachers. While the colloquial definition of teaching may accept a tool like an intelligent tutor as a kind of teacher (if only because many intelligent tutors simply resemble the actions of a classroom teacher), it mostly ignores other kinds of teaching through tools. By focusing on the actions that go into these kinds of teaching events, we can account for these and other interactions that a more traditional conception of teaching cannot, and expand what "counts" as teaching.

I will now turn to a specific example of teaching in a particular videogame, *Dota 2*, in order to more thoroughly describe the ways that a videogame can teach. This game demonstrates the ways the game designers have created experiences that are especially good for learning, uses teaching acts effectively to promote deep learning, and especially honors the principles I have described above to optimize player learning. With this game as a specific case, I also want to make it clear that the game teaches—outside of any formal institution—and that it might serve as a model for recognizing and even creating teaching in all kinds of forms.

CHAPTER 5

VIDEOGAMES AND INFORMAL TEACHING IN *DOTA 2*

In the previous two chapters I argued that teaching is a way of designing experiences for uptake, and that teaching is made up of some combination of teaching acts (motivating, showing, telling, managing attentional economy, orchestrating participation, assessment, and feedback). I presented empirical evidence based on Hattie's Visible Learning work for effective strategies for teaching and developed a set of principles that make up "good" teaching and showed how those principles manifest in particular videogames. I have also been making the claim that teaching happens across a range of domains, both inside and outside of formal settings like schools, and is done by a variety of actors, both people as well as tools like videogames. I have presented some brief examples of the ways games demonstrate good teaching principles.

This chapter is dedicated to providing deeper analysis of a single game to show specific examples of informal teaching in action and to show how games can deliver on the principles of good teaching I developed earlier. Using the game *Dota 2*, I will look at design features of the game in order to "reverse engineer" the teaching elements. I have chosen this game for two important reasons: first, it is a tremendously good game in its own right and demonstrates a great many examples of good teaching; second, and more importantly, *Dota 2* contains a number of "hooks" into larger spaces for teaching and learning "around" the game in places like YouTube tutorials, theorycrafting websites, discussion forums, and other "extra-game" sites. Some of these hooks are specifically sanctioned by the game's developers, Valve, while others leverage the interconnected and emergent nature of modern digital media.

Indeed, I see this chapter and the next as two sides to the same coin; this current chapter is dedicated primarily to the "game" proper (which includes the game client or "hub" with things like an information database, live game streaming, and a marketplace in addition to the actual gamespace), while the next chapter is dedicated to the extra-game spaces. I have separated the two teaching "sites" to clarify certain features of each, though in many important ways the real power of a game like *Dota* 2 is the way it demonstrates a kind of "distributed teaching and learning systems" model that provides many avenues of exploration (learning) and scaffolded support around a complex problem (e.g. a game).

I believe that this kind of teaching occurs frequently in the everyday world, in many "informal" settings, but that we often don't honor these moments as real "teaching." However, I will argue that this model of informal, distributed teaching (demonstrated by *Dota* 2) might prove transformational in schools and elsewhere by allowing multiple pathways to participation grounded in deeply contextual practice. It will also demonstrate how designing these kinds of networked teaching opportunities is an integral part of the *Dota 2* gameplay specifically, how design manifests in informal teaching more generally, and what it might tell us about teaching in formal places like school.

For now, however, I want to focus on what happens "in" the game itself. *Dota 2* uses many features within the game which show good teaching in action; this is not an analysis of each and every instance of teaching acts, nor a "play-by-play" of each tutorial level or game feature, though there are plenty of good examples. Rather, this analysis will

highlight how a designed tool like a videogame can teach as a way of suggesting that we should broaden our understanding of what and where teaching happens.

Dota 2 and Informal Teaching

Dota 2 is a Multiplayer Online Battle Arena (MOBA), a sub-genre of Real-Time Strategy (RTS) games, and is published by Valve Software, Inc. The game was released in 2013 as a free-to-play game, supported by sales of in-game items like cosmetic character items and additional voices for the in-game announcer. The game is available only on PC, Mac, and Linux through Valve's own software distribution service, Steam. The game is currently the most played game on Steam by a roughly 3:1 ratio (on average over 700k unique players per day, compared to the next-highest title, *Counter Strike: Global Operation* which peaks at just over 200k unique daily players). *Dota 2* also has a very large "professional" competitive scene, which includes Valve-sponsored tournaments such as the recent *International 2015,* which offered over $18 million in prize money. The competitive scene is one of the most important factors in *Dota 2*'s popularity, a fact I will return to later in the next section and more fully in the next chapter.

MOBAs, as the name indicates, are online games played in cooperation with and competition against other players, though *Dota 2* does offer an "offline" mode where a single player or group of players can play against the computer. *Dota 2* is played by two teams of five players each who must attack the opposing team's base while defending their own. Players can select one of over 100 "heroes" for each match, and each hero has unique abilities and limitations. During a match, players gain experience points and gold

which they can use to upgrade their character's abilities and purchase equipment, respectively. There are many different strategies possible in each match depending on the composition of each team and their plan of attack ("rushing" the opponent with all 5 heroes, fighting a battle of attrition, playing "hit-and-run," and so on).

Figure 1. Combat in *Dota* 2. A typical screen during combat in *Dota 2*. The screen shows a great deal of information including player health and status, abilities, numerical information about their character, inventory, a map of the overall playing field including positions of allies and enemies, the playing field, statistical information, a chat feature and much more. This screen is animated and constantly changing, though elements of the interface stay relatively static.

Dota 2 shares many of its design features, mechanics, and play styles with other games, both within the MOBA/RTS genre and other competitive games. For instance, games like *StarCraft* and *League of Legends* boast competitive tournaments and active, diverse communities (indeed, *StarCraft* is somewhat apocryphally referred to as the "national" sport of South Korea, with a dedicated TV channel akin to ESPN featuring competitive *StarCraft* matches). *League of Legends* in particular shares many features

with *Dota 2* as they have a common origin (both were inspired by the same influential *Warcraft III* mod known as *Defense of the Ancients,* which arguably started the MOBA genre). *StarCraft* and *League of Legends* both allow for multiple play strategies, as do other competitive non-MOBA/RTS games like the *Call of Duty* franchise or *Team Fortress 2* (both First Person Shooters [FPS]), the *Civilization* series (Turn-Based Strategy [TBS]), and even non-digital games like chess or *Risk*. It is the integration of the various social learning sites that sets *Dota 2* apart and, along with the game's well-designed teaching principles, was the reason it was chosen for this particular analysis.

So what does *Dota 2* teach? As I argued in the Chapter 2, *what* the game teaches is less important than *how* the game teaches, but it is not inconsequential. The "what" (content, mechanics, etc.) drives the "how" (what act of teaching is most effective, in what way, at what time, and so on). In the broadest sense, *Dota 2* must teach how to play the game: what the goals are, what success and failure look like, and the techniques to achieve these. Because it is a designed problem with arbitrary tasks and arbitrary rules, players must understand both of these facets of the game. They must also navigate multiple semiotic domains (the mechanics of the game as well as the interface), so a player needs to learn how to operate both the operational and conceptual levels of the game.

But *Dota 2*, like virtually all games, must manage a delicate balance between challenge and mastery. If the game is too easily mastered, for example as in tic-tac-toe (Koster, 2004), players may quickly lose interest. A game that is too challenging (in terms of highly complex gameplay, like *Dwarf Fortress*, or in terms of difficulty, like *Demon's Souls*) may also be quickly abandoned. The intersection of teaching and games,

then, must honor the spirit of "gameness" (players want to be challenged, but not too much) while still delivering on good learning (learning geared towards mastery). *Dota 2* resolves this tension in part through the design of the challenges themselves (they are complex and not easily mastered), in part through the enacted play (the many varied strategies players actively use), and in part through the design of the teaching events within the game (which teach *strategies towards mastery* rather than direct solutions).

Furthermore, *Dota 2* faces an additional challenge inherent in most games designed for a broad audience: players come to the game with a diverse set of previous experiences with similar games and with other digital media, and they will have many different goals (to "mess around," to play socially or competitively, to develop deep expertise, to participate in the affinity spaces around the game, to connect to the "cultural" touchpoint of the game and so on). This is a problem faced by most classrooms, by the way. *Dota 2*, unlike many schools, has the luxury of designing many different teaching interventions that the player (learner) can encounter in many different ways—some intentionally designed and placed, some at the player's own discretion. Nevertheless, it is a commercial necessity that *Dota 2* must provide a way of initiating very novice players into the game by teaching them what experts might consider "basic" information in order to keep the novice players interested (and therefore paying) while still accommodating experts' capacity to "skip" this introductory orientation. *Dota 2* must be designed in such a way as to allow new players and highly skilled players to share the same space.

Lastly, because the game is organized around a mastery orientation, there are many skills and much knowledge to be learned over time. I am not concerned in this

particular analysis whether uptake occurs at any given moment or during any single teaching intervention, but that the *conditions for uptake* are present and driven by good teaching principles. The game offers some clear evidence of low-level skill acquisition (can I move my character, can I open the menu and so on), and through repeated practice and interactions with the game system it is certainly possible to demonstrate higher-level knowledge acquisition (strategies, team composition etc.). I am consciously disassociating teaching with learning in order to understand what makes something a teaching act. This dissertation is interested exclusively on *how* the game teaches players as evidence of good teaching acts, not whether or not a player actually learns that topic.

So, with these important conditions in mind, let me return more directly to the question I raised earlier: what does the game teach? One way to answer this question is to describe the goal of the game. The in-game tutorial includes the following description of the overall structure and goals of the game:

> *In Dota two teams face each other across a vast battlefield. The teams, called Radiant and Dire, are each made up of five players. Whichever team is able to destroy the opposing team's Ancient will claim victory.*
>
> *Across the battlefield are scattered a number of important locations, from monster infested jungles to the river which divides the team's starting territories.*
>
> *As the match begins each player chooses a hero from a diverse roster and then spends their starting gold on a handful of inexpensive items. Within each base are three sets of barracks where uncontrollable units called "creeps" march forth. These creeps progress down one of the three lanes towards the enemy base. Each lane is protected by three defensive towers which will attack advancing creeps or heroes.*
>
> *In the early stages of a battle heroes have yet to gather their strength and may wish to travel with their creeps for protection from enemy creeps and*

> *other forces. As the battle continues, heroes kill enemy creeps and enemy heroes to gain gold and experience. This will allow them to gain power and begin assaulting the enemy team's outer defensive towers.*
>
> *The river is the source of runes. Runes provide temporary but powerful bonuses. Heroes may sometimes find it safer to attack neutral creeps in the jungles or they may gather to assault the mighty Rashon in his lair, hoping to harvest his resurrecting Aegis of Immortality.*
>
> *In time a team will become powerful enough to advance their forces into the enemy base, where they may destroy the enemy barracks to grant themselves "megacreeps" in that lane.*
>
> *Once they have breached the enemy's inner defenses, the team must attack and destroy the Ancient to claim victory.*

In the simplest terms, players must defend their base while destroying their opponents' base (the Ancient). They work in cooperation with other players on their team with the support of computer-controlled characters, and the opposing team does likewise. Each player can choose from a variety of characters to use, each with their own skills, weaknesses, and strategies and team composition is important (where complementary skills and roles are often quite beneficial). There are three main pathways that players can use to get to their opponents' base, though these are heavily defended. These are the fundamental concepts that players must learn in order to participate in gameplay.

But this only tells part of the story; this describes high-level and abstract ideas about the game—how to win, how the gamespace is organized and so on. To actually *play* the game requires a lot more than just knowing these things. It requires manipulating the game's interface (moving the camera, selecting and activating abilities, even locating the "Play" button from numerous other choices within the game client). It requires knowing the differences between the various characters and their abilities (including

knowing when and where to use them appropriately). It requires knowing what each icon and symbol means on the screen. And, ultimately, it requires knowing how to react on-the-fly as the game changes through the course of play.

In short, teaching the player how to play isn't just about teaching them the rules or goals but also about teaching them how to actualize these things. It's about teaching all the various actions it takes to actually play the game, and how those actions combine into the game itself; it's about teaching relationships between discrete parts and larger wholes. These are the things that games do very well, in fact. First, games are all about action, and I have already made the case for the importance of teaching and learning as active processes. Players (learners) must *do something* in order to progress, and the act of doing is both a conceptual component of play (what they are supposed to do/learn to do) and a functional tool in playing (how the game/learning is enacted). Second, games can be designed to structure, sequence, and scaffold experiences from explicit and specific actions to generalized patterns of play.

It is this second feature I want to turn to next: how the game is designed to create good experiences for learning. As I argued in Chapter 2, experiences good for learning possess key features including actions the learner must take, clear goals, something at stake, constraints to limit cognitive overload, and places for the learner to plug in to other tools and minds. I further argued that designing these experiences also must possess key features including highlighting and backgrounding information, be ordered to emphasize some associative pattern, providing a non-trivial challenge, setting some goal, and providing useful feedback. I want to explore how *Dota 2* is designed—the primordial teaching act—before looking at specific examples of teaching acts in the game.

Note on formatting. Since I am also aligning the game's design and the way it uses the various teaching acts to the principles of good teaching from the last chapter, I want to point out which principles are in play in a given teaching event. However, for the sake of brevity, I wish to simplify the descriptions necessary to convey what principle (or principles) is being utilized. To that end, I will simply write out the principle in the following manner and only provide specific additional description when absolutely necessary: **[Teaching Principle]**. My aim is to suggest at these various points which relevant principle(s) is reflected by the teaching act in order to show how the game design honors good teaching.

Design in *Dota 2*

Dota 2 is a complicated game; there are many different play elements, numerous variables, and a range of interface features. I mention this for three reasons: one, it reinforces the idea that the game must teach a great deal of information, skills, and actions to a player; two, there are a number of design features that build good experiences for learning; and three, I will not attempt to cover every single instance of teaching or design but to highlight a few illuminating instances. This chapter will focus on one key part of the game (the in-game tutorial) with an understanding that these are not the only design features that are worth exploring and that this list is not exhaustive. This tutorial section is overwhelmingly the site of the most explicit design features—and teaching acts—and provides some of the clearest evidence of teaching in the game. I highly

recommend watching the tutorials to get a better sense of how these things are connected and flow for the player. The playlist is available at www.distributedteaching.com.

To help manage the complexity of the game, Valve includes an optional, multi-part tutorial which covers everything from basic camera and character movement to complex, multi-player battles (essentially, the "real" game). The tutorial is completely optional; players can choose to complete it—in its entirety or only portions of it—or not **[Timing Principle]**. The game is forgiving enough that players can dive in without the tutorial and have some success (i.e. play the game), though they will likely not be very good and may face a much harder time mastering the game; in particular, opposing players with even a moderate amount of experience or skill at the game will probably overwhelm the new player. Because *Dota 2* shares many features of other games, especially those in the MOBA and RTS genre, new players may come in knowing certain conventions of those genres (like camera movement or how to use the action bar) and find greater success than a complete novice. The tutorial is meant to serve both true novices as well as players with game experience outside of *Dota 2*.

However, it's also important to recognize that the tutorial does not (and arguably is not meant to) teach everything the player needs to know for mastery. Instead, the tutorial is an "on-ramp" which introduces concepts that the player will use over and over again through the course of their play. These tutorial sequences are small, structured samples of the real game (the complex systems I described above). The tutorial is, in some ways, an invitation for the player to continue playing (and learning) the game and not "full" coverage of the game. In this sense, it's also important to recognize that the

player will have to do a great deal of work to reach mastery; the tutorial is just the first (well-guided) step.

The tutorial is broken into eight scenarios, each covering a different topic but also organized sequentially so that the scenarios build on top of what previous tutorial sections covered **[Connecting Experiences Principle]**. Players can play any of the tutorial modules only after "unlocking" them by completing the previous module, but they can repeat previous modules as many times as they'd like **[Opportunities for Deliberate Practice Principle]**. The tutorial section also includes two special modules designed as "testing grounds," where players can play a match against the computer to work through the material they just learned in a safe, low-risk environment.

The eight scenarios cover increasingly complex play events. The first scenario is actually non-interactive, instead containing a 4-minute overview of the basic mechanics and goals of the game (the dialogue of which is transcribed above). The second scenario introduces basic movement controls and actions as well as the first instances of melee combat. The third scenario introduces ranged combat and a different hero than the previous scenario. The fourth scenario covers the concept of "lanes" and "towers" (two central features of the map and strategic elements of play). The next two scenarios are skirmishes/practice; one is constrained to just the middle lane, while the other is a "full" match with all three lanes open. The seventh scenario expands on a more specific skill, "last hitting" or killing an enemy to gain gold, as a key feature in high-level play. The final scenario is a practice focused on last hit practice.

The sequential nature of the tutorial modules is suggested by the presentation of the interface; the modules appear as "towers" or landmarks on a map that players select,

with each tower (module) connected by a path to the next (see Figure 4.2). The map even suggests a hierarchical distinction between the modules, with the four top modules (which cover basic gameplay topics) separated by a river from the bottom two (which cover more advanced material) and the special battlegrounds.

Figure 2. Tutorial Map. The tutorial map provides a conceptual metaphor for the organization and sequence of the training modules

The design of this interface—the metaphor of the map—is one way of foregrounding what is important about the game and how the player should use the interface as well as providing a conceptual preview of the material to be covered **[Learner's Perspective Principle]**. It is a method of constraining the experience of the tutorial (and the sub-

tutorials) to discrete and manageable components and of helping to organize the player's attention towards the key elements of the tutorial, and to the game proper. This is a subtle example, but it is reinforced by the use of the interface itself: players must click on the appropriate tower; if they try to use a module they have yet to "unlock," the game won't let them and will even give them a quick audio cue indicating that they cannot select that module. This map metaphor provides a nice example of connecting the mechanics of the interface with the concepts of the game, working together to guide the user through the tutorial.

Module 2: Designed teaching. Let's look at the second module more closely (the first interactive module) since it contains some of the most basic—and therefore most overt—teaching designs. In the next section I'll look at the teaching actions more directly, but here I want to focus on the way this module is put together and what that says about the design of these learning experiences. From the module's description, this tutorial covers: hero movement, hero leveling, ability usage, items, basic combat, and combat: last hits. These are the core abilities and features of the game.

After a brief introductory cinematic, the player is told how to move the camera (Figure 4.3) in two different ways (by moving the mouse to the edge of the screen or by clicking the middle mouse button and scrolling) **[Developing Strategies Principle]**. They are then tasked with moving to a location beyond their current view and *must* use that information (how to move the camera) in order to progress **[Clear Goals Principle]**.

Figure 3. Camera Strategies. The game provides several different strategies for moving the camera (moving the mouse or using the middle mouse button)

Players are then tasked with defeating a single creep (a new problem to face and a new skill to utilize). Once they have defeated that creep (relatively easily), they confront two more. These two creeps also die relatively easily, while the player has gotten additional exposure to the mechanics of combat **[Opportunities for Deliberate Practice Principle]**. They face one more creep before leveling up (after moving a fair distance across the map, since they have already proven competent at movement). After leveling up, they have earned a new skill (that they manage by using a new portion of the interface), which is then tested by facing three more creeps. It is easiest to defeat these creeps by using the new skill, so the fight is practice in (and a test of) using the new skill **[Connecting Experiences Principle, Developing Strategies Principle]**.

After these four brief encounters (lasting maybe two minutes in total), the player has already demonstrated competence with controlling their character, moving the

camera, engaging and attacking enemies, managing the interface elements like the action bar, and using several skills. The game is designed in such a way as to build new skills on top of plenty of practice of "old" skills and to sequentially structure harder and harder problems. Not only do players demonstrate their acquisition of these new skills and knowledge, but they are being gradually introduced to the complexities of the "real" game, gaining experience using the fundamentals of the game mechanics while simultaneously progressing towards more difficult tasks which make up the game "proper" **[Challenge Principle]**.

From there, players must move to a vendor and purchase and equip items (yet another new skill and a new interface to manage). They then must defeat three different camps of creeps and gain another new skill, then go and purchase and equip another item (iterating on experiences they've already encountered rather than introducing new skills or knowledge). Next the player must battle more creeps but this time alongside a computer-controlled Hero who heals the player (both iterating on a previous experience, i.e. combat, as well as modifying this experience by introducing the element of cooperation and the relationship between Hero roles) **[Connecting Experiences Principle]**. After defeating these enemies, the player returns to the vendor and purchases a new item that they then modify (again, both iterating and modifying a previous experience). Then, after a few more combat encounters and gaining additional levels and skills, the player faces off against a computer-controlled Hero. By this point, the player is overpowered compared to the enemy "boss" and defeats them easily. This tutorial module sequences events and builds them on top of each other so that players gain both insight and practice in using them during the course of play.

This scaffolded approach is also apparent in the amount and frequency of teaching acts present in the sequence of tutorial modules. In the second module described above the game includes 34 pop-up/dialog boxes, with 22 of them including some kinds of showing/telling prompt, as well as 7 times where the action "stops" until the player demonstrates competence with the new skill or feature at hand. By the fourth module, there are only 4 dialog boxes and 1 "stop," and that is at the beginning of the module when it introduces the new concept of starting gear. Within the span of three modules, the teaching interventions drastically drop, and players are mainly practicing the skills they have learned. After the fourth module (akin to a mid-term), the interventions increase as more advanced features are taught in the final two modules.

Through the design of the levels—the way they introduce a concept or action, let the player enact it, then cycle back and modify it to build a larger systemic relationship structure between elements— a number of the features of designed experiences for learning are evident. Certainly the sequencing of tutorial within the module points to the way the game highlights or foregrounds certain information and backgrounds others as well as how it emphasize patterns of play, presents interesting and non-trivial goals to the player, and provides feedback. From a design perspective, Valve captures all of the elements of an experience good for learning.

The same can be said from the player's perspective; playing through the tutorial contains all of the features of an experience good for learning. The player (learner) has actions to take towards solving some problem (they must control the Hero and complete the various tasks at hand). They have clear goals (both explicit ones, such as moving or opening the interface, as well as implied ones, such as not dying). Something is at stake

for the player (if nothing else, the time it takes for them to participate, though things like ego, reputation, natural curiosity and the like are also possibly present for them to engage at any meaningful level, i.e. to continue playing). The experiences are certainly constrained (they begin with almost no play options but movement and gradually encounter new information in scenarios where they will first need it, e.g. combat abilities when fighting enemies). And the learner can in many ways "plug in" to other tools (in this case, primarily the game as their Hero "knows" what to do in combat and "how" to move; see Holmes, 2015).

Simply put, the tutorial section of *Dota 2* functions as a designed experience that includes all of the features that make the experience a good one for learning. That is, the game teaches through its design, and it is designed to teach. It is worth noting that the tutorial section, especially Module 2, is often highly didactic in that the game is focused on core or baseline knowledge and explicit instruction; the game tells the player how to do something specifically and directly and then waits until the player completes that task. I'll take up this theme more in the concluding section of this chapter. I also preview how these didactic moments might work in conjunction with other teaching designs within and beyond the game, which I dedicate the next chapter to. Here I want to turn to the various teaching acts more directly, and show how each manifests within the game to further make the case for the ways *Dota 2* teaches.

Teaching Acts in *Dota 2*

I want to focus on the teaching acts in *Dota 2* because I believe the game demonstrates so clearly not just that it teaches but that it teaches very well and, indeed,

uses a number of the principles of good teaching that I developed based on Hattie's work. My point here is not to describe every single instance of teaching, but rather to pick out a few illustrative examples which show how the game aligns to good teaching and, perhaps, to think about where else these features are present, in and out of school. I have already been making the case that teaching is anywhere were a combination of these teaching acts occur (*showing* by modeling, *telling* in rich and interesting language, *building motivation* to engage with the task, *orchestrating participation* to promote active learning, *constraining* the event to something specific and defined, *assessing* how the learner is doing and how their own teaching is working, and *providing feedback* to themselves and to the learner). Here I want to highlight these actions through specific examples in order to begin building a method for looking at when, where, and how these acts work best.

I also want to reiterate the claim I made in the last chapter about the interrelatedness of these acts. These acts often occur simultaneously, and an act can serve several functions. For example, below I will use a feature of the game where the interface is "built" as the player progresses to describe several different acts; this feature is an example of showing (it literally appears on the screen) and of constraining the event (it was unnecessary information before that point); it is also frequently accompanied with explicit telling through text dialogues or voice prompts. I have tried to describe one facet of some event in order to isolate the specific teaching act, but it should be clear through my descriptions that they are often intimately intertwined. The point is that these are generally not isolated actions even though I will describe them individually; I also believe that, more broadly, it points to the way that these various acts combine to do

something “bigger” (i.e. teach) effectively and it is worth considering that the relationship between these acts is just as important as the specific acts themselves.

Showing. Showing refers to modeling, demonstrating, or illuminating something, especially through images and visually rich representations. Showing can be explicit, as in a demonstration, although it can be implicit as well, as in attitudes, gestures, disposition and so on. *Dota 2* captures both of these kinds of showing well through a number of different events.

The tutorial modules contain a number of examples. The first module is non-interactive, instead containing a 4-minute narrated overview of the basic mechanics and goals of the game. The game slowly pans over the map while highlighting key features (Video 2.1, available at www.distributedteaching.com) accompanied by the narration transcribed in the section above. At several points during the narration, the object in question is highlighted on the screen (for example, when discussing the “barracks,” a red outline appears around the object). This combination of showing (highlighting) and telling (naming) calls attention to the object and helps the player focus on the salient part of the game.

This module also shows what combat looks like to the player, providing a good model of the game in action **[Learner’s Perspective Principle]**. Players see creeps and heroes fighting, and get to follow them around the map **[Connecting Experiences Principle]**. They are not shown or told all the specifics of combat (for example, the hero units all use special abilities during the demonstration, though these are never explained or highlighted), but they are introduced to the general dynamics of battle. The module

itself even follows the overall sequence of battle, from the starting arrangement of the playing field and heroes choosing their initial skills and items, to combat in the "lanes" between heroes and creeps and with defensive towers, and finally to assaulting the opponent's base and defeating the enemy's Ancient, signaling victory **[Connecting Experiences Principle]**. Here the showing acts are designed to preview to the player what they themselves will soon be doing, and to provide a model for what success (and failure) look like.

In the second module, players are told to move their hero to a specific location (Figure 4.4). The game uses a flashing green arrow to show where to move, drawing the player's attention to the right spot **[Clear Goals Principle]**. The first three times the player is supposed to move, this green arrow appears at the location **[Developing Strategies Principle]**. Subsequent movements do not include this indicator. The game uses showing (where to move) to provoke player interaction.

Figure 4. Triggering the Next Learning Event. A green arrow flashes on the location the player needs to move to in order to progress; this arrow is combined with the text over the NPC.

As I mentioned above, the game "grows" or builds up the interface gradually as the player encounters new skills. At the start of the tutorial, the player's action bar along

the bottom of the screen displays only their hero's portrait. After several of the movement tasks described above, the player is tasked with attacking an enemy creep. The hero's health bar suddenly appears on the action bar and over the avatar's head on screen; now that they are in combat, the relevant information (their health) is available **[Timing Principle]**. After several more fights, the player "levels up" and again a new element of the action bar appears (the skills buttons and the player's stats). Once the player has gained that new skill (by demonstrating competence with the basics of movement and fighting), the game very overtly adds new information (Figure 4.5). The sudden appearance of new interface elements (that is, showing new information) quickly calls attention to something new for the player to attend to, just when it becomes relevant (just-in-time).

Figure 5. Ability/action Bar Progression. The ability/action bar on the player interface grows as players progress through the module and new information becomes relevant: a) at the outset of the module when the player has no abilities very little information is displayed; b) when the player encounters combat for the first time the health bar appears; c) once the player levels up and gains new abilities the action bar slots appear and hover/tool tips are available (see also Figure 4.6); d) the player adds abilities as they level and "complete" the action bar.

The appearance of the new skills on the action bar also includes a small box next to the character's portrait with that include the player's stats. The player can get additional information by "hovering" their mouse over various parts of the stats box (Figure 4.6).

Figure 6. Tool Tip. A "tool tip" which displays additional statistical and "flavor" information about a skill

This information includes detailed numerical data about their armor or damage abilities and more. Here, the game is providing information to the player "just-in-case" **[Timing Principle]**. A new player doesn't necessarily need to know the formula for their armor rating at this point in the tutorial, nor might they yet understand a string of numbers next to a blue square, but they have the option of looking at it more closely if they choose. In fact, the game does not overtly state at this point that players can get these "tool tips," though it is often a convention of the genre, and it can easily be "accidently" discovered during the course of navigating the interface. This kind of information, however, can be a crucial component of expert playing and deep knowledge of the game system, so the game is providing an early on-ramp for this deeper learning—if the player so chooses **[Where To Next Principle**].

There are several other similar examples of the interface being developed "in front of" the player, including the shop interface where players buy equipment, the "mini-map," and the courier interface. There are also other examples beyond interface building which use showing to indicate what is important or relevant to the player (for example, when the player is told to purchase a specific item, that item is highlighted in the

shopkeeper's inventory while all the other items are "greyed out," so that the player focuses on the right item and can ignore the others; see Figure 4.7).

Figure 7. Merchant Screen. Note the only "actionable" item (the Stout Shield) is highlighted while all other items are greyed out; players cannot use these items and the interface effectively disables/backgrounds them.

All of these examples highlight the importance of showing to framing the player's attention as well to the just-in-time/on-demand/just-in-case nature of the information.

The game also contains a great repository of information—and teaching acts—outside of the tutorial modules or gameplay called the Library (Figure 4.8). This is another optional section of the game client where players can look up information about all of the heroes (currently 109 of them) as well as items and more (easily several hundred items) **[Timing Principle]**.

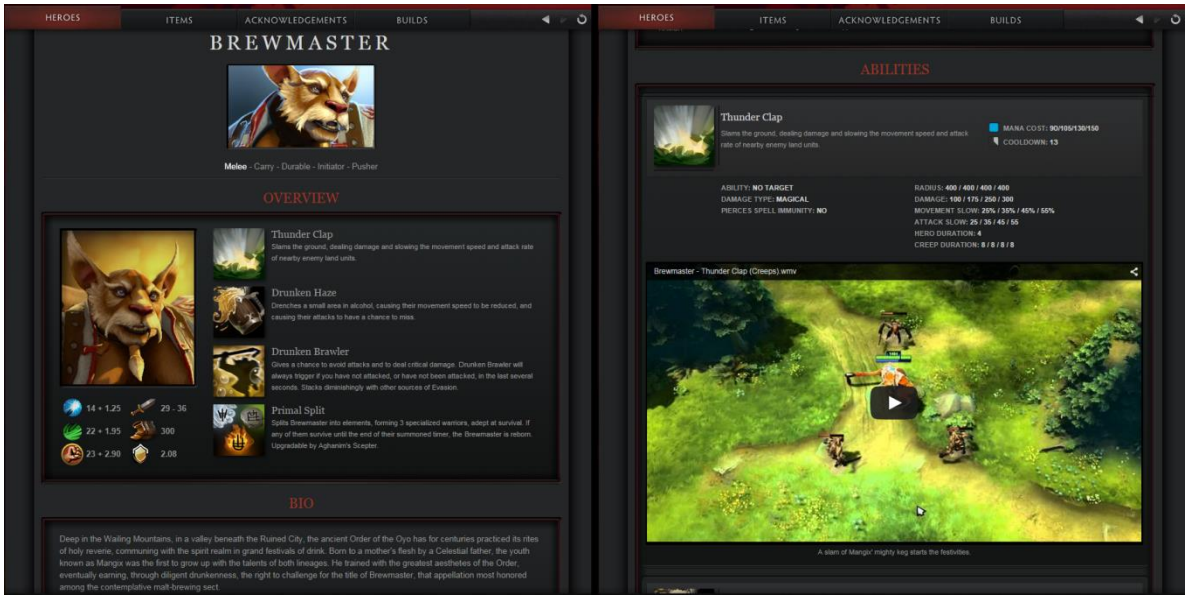

Figure 8. In-game Library. Two views of the library (actually one long "webpage" like element). This feature includes textual information about the mechanics of an ability as well as "flavor" text, hover/tool tips, statistical information, and even a video demonstration of the ability in action.

Within each character "page," there is detailed information similar to that contained in the tooltips but expanded in terms of narrative description. Each character page also contains a description of the hero's various abilities accompanied by a very short video clip of the ability in action. These videos serve both functions of showing. They certainly show a specific example (model) of the ability in action, tied closely to some statistical information; it "shows" what the attack "should" look like in order to let the player know when the ability works and, potentially, how it should be used (in what situation, against what enemies, and so on) **[Developing Strategies Principle, Connecting Experience Principle]**. It is showing as a demonstration.

But this kind of showing also serves the second function of showing in that it shows the player what "success" should look like and what they should look like as a successful player. That is, it is a model of how to act and what successful actions the

player should strive for. Similarly, the first tutorial module shows the battlefield and the various enemies and Heroes; it does so to preview the space and tools the player will use but also to build a kind of "norming" narrative world (it is a high-fantasy world where combat is essential) and norming actions (fighting, killing, and conflict are part of the world). In other words, it's showing the player what their experience should look like and what to expect as they keep playing the game **[Connecting Experiences Principle]**.

In a similar way, the tutorials also show players how they should act within a match. They are introduced to the system of leveling up, for example, and shown that as a weak hero it is beneficial to stay near friendly creeps. It also shows players that they need to attack the towers rather than skip by them, again sanctioning a particular kind of play. These expectations also make their way into the community of players, so that a player who doesn't play the game "correctly" (according to the standards established by the game and enforced by the players), may be reprimanded. Of course, the community often adopts different strategies and norms than the ones suggested by the game to gain a competitive advantage or just for fun, but the general "rules" of good play are created at this tutorial level. This is showing as an identity building tool.

Telling. Telling refers to informing through rich language and is usually overt. However, like showing, telling can be both direct, as in instructions, as well as implied, as in the types of language used, attitudes, and affectations. In videogames, which are generally highly visual media, telling is often accompanied by acts of showing, though the second form of telling (implied) might simply be ancillary (such as the language and

tone a Marine drill sergeant uses in *Call of Duty*). *Dota 2* contains a great deal of telling of both kinds (Direct and implied) as well.

The first tutorial module, as I've mentioned, contains a long narration of the events unfolding on the screen and the overall goals of the game. To begin this module, the player must select the icon from the menu and click it. When the player clicks on the icon, a pop up "title card" appears over the map with the following written on it:

> *DOTA OVERVIEW*
> *A quick study of the game in action*
>
> *This introduction to Dota 2 will familiarize you with the location of map landmarks such as:*
> - *Bases*
> - *Towers*
> - *Barracks*
> - *Lanes*
> - *Roshan and the Aegis*
> - *The Shopkeepers*
> - *Runes*
>
> *You'll also be exposed to key goals of the game, and get an idea of what battle will look like.*

Here, the designers have included several key framing devices for the learner by telling them what the goal of the tutorial is, several key terms, and what they should expect to know once they've completed the module. Even in this brief text they are helping to organize the player's attention (i.e. look for things like "bases," "towers," and "Roshan and the Aegis," in this module) and helping to foster experience with the terminology and mechanics of the game.

There is a significant amount of telling—especially in the first several tutorial modules—in terms of explicit directions (e.g. things like "move your mouse to the edge of the screen" or "kill three creeps with your sword"). These instructions are meant to

clearly and concisely describe the task at hand and the actions the player can (and should) take **[Clear Goals Principle]**. They might also be intended to highlight that there is more than one way to do things and that players might want to experiment with different approaches, as in the camera controls description (players can move their mouse to the edge of the screen or they can use their middle mouse button and drag; refer to Figure 4.3) **[Developing Strategies Principle, Opportunities for Deliberate Practice Principle]**.

The game also includes a great deal of "ancillary" telling through things like the text in the tool tips or in the Library entries. In Figure 4.6, for example, the tool tip for Dragon Knight's Breathe Fire ability provides a literal/mechanical description of the ability (it does damage to enemies in a line in front of the character) but it also includes "flavor" text (comparing the ability to the fictional Eldwurm Slyrak, a bit of supplemental lore for the world of *Dota*) **[Timing Principle]**. Figure 4.8 does the same general function, telling something direct about the ability but also some narrative description to flesh out the characters more fully.

These instances of telling reflect the dual nature of telling in that, much like showing, telling can be both highly didactic but also normative. The tutorial modules especially serve as socializers into the world of *Dota 2*, through both language and through creating experiences with the mechanics of play. Both are important factors in helping create a particular kind of player (that is, a particular kind of socio-cultural identity). The game introduces many key terms to the player, especially names of characters and objects. For example, the weak, non-playable characters are called "creeps." In other games, these types of characters are referred to by other names such as

"mobs," "NPCs," or "goons." *Dota 2* is providing an officially sanctioned term for these characters that is picked up by players, who then use the term in their own discussions. The game tells players what to call these creatures, which the community (in most cases) adopts and enforces. Here, telling works as a tool for creating a kind of player and a kind of approach to engaging the game and other players; it is, like showing, an identity building tool.

Motivating. *Dota 2* faces an especially tricky problem when it comes to creating motivation for a player because of the sheer complexity of the game. In the previous chapter I briefly mentioned that games often activate both extrinsic and intrinsic motivation within players. Indeed, one of the claims about games for learning, especially in formal school settings, is that they are more engaging and more motivating than other types of activities. This is, of course, a very broad and general claim and one which may hold up under scrutiny only partially. But there is some evidence that games especially align with the way the human mind works in that games allow for role playing, model building, are goal oriented, and foster multiple iterative "play" encounters to build associative experiences (see, for example, the discussion of Koster in Chapter 2; see also Gee, 2003).

So as a *game Dota 2* has some potentially inherent motivating/engaging features by its very nature. It also uses a number of motivating acts specific to the game which help to create motivation in the player to learn to play the game and continue playing. But I want to pause briefly here to stress that *Dota 2* is a very demanding game, and requires a great deal of effort on the part of the player to not just learn but to master it. As I stated

above, the in-game tutorial only covers an almost superficial amount of the actual learning necessary to master the game; it introduces some key features, ones that are absolutely necessary to playing but which hardly account for the deep and sophisticated knowledge it takes to "learn" the game. As a somewhat crude metaphor, it's like teaching someone arithmetic and then expecting them to master quantum physics. The tutorial modules are there to *begin* the learning process for the player, and to shape their initial experience and give them a frame for their continued play, but mastery requires a tremendous effort by the player. Unlike relatively "simple" games (I use that term to mean games with only a few mechanics or rules and not in a pejorative sense) like *Tetris* or *Lyne* or *Candy Crush Saga*, where learning the core mechanics is generally straightforward, clear and quick, learning how to play *Dota 2* takes a real commitment from the player—a commitment in terms of time, mastering a number of variables, and overcoming frustration. So the challenge *Dota 2* faces is to motivate players to remain engaged through this deep, messy, complicated process of learning and mastering the game. Motivation, for *Dota 2*, is about convincing the player that it is *worth the effort* it takes to play the game well.

A great deal of this motivation actually comes not from the game itself but from the social nature of the game. The following chapter will look at these feature of the game more fully, but I want to recognize the importance of the various social features of the game in terms of creating and sustaining motivation for players. *Dota 2* is ultimately about playing with and against other players, and the game is built around fostering interpersonal play. The game includes a number of direct "hooks" into the player's social network (including linking to their Steam "friend list" as well as building player groups

or clans). The game also promotes a number of game streaming options, including spectating in professional or amateur tournaments, live-streaming their own game or watching friends' or professionals' games, and an annual in-person competition with a corresponding streaming special feature. These streaming sessions contain a dedicated audience chat channel which is often a robust mix of game-related commentary and personal conversations. Beyond the game itself, there are myriad sites such as Twitch.tv, YouTube, message boards, theory-crafting sites and more that allow players to engage and interact with other people. A very significant feature of *Dota 2* is these various interactions that occur tangential to the game proper. Therefore, it's safe to say that a great motivating factor for many players is the social interaction, and that they "commit" to playing the game in order to be a part of these various social events. With that in mind, it's easier to spot a few of the design choices that Valve made which promote these motivating social interactions. Again, this claim is the bulk of the following chapter, but for now it is clear that Valve designed and accounted for these opportunities to motivate the player's participation and engagement.

As far as specific teaching acts for motivating goes, the game includes a number of examples. The sequencing of events in the tutorial module above is one example. The way the game presents a well-defined problem (kill a single creep), lets the player complete the task, and experience success quickly helps overcome the initial confusion of a new game system **[Clear Goals Principle, Opportunities for Deliberate Practice Principle].** The player feels as though they can succeed, even though the game has effectively thrown them a "softball" with an easy-to-defeat enemy (this is partly what Gee calls the Performance Before Mastery Principle, meaning the player actually does

things before they are experts). Then the game ramps up the challenge slightly (they must kill three creeps this time), though this is still an unfair fight heavily skewed towards the player **[Connecting Experiences Principle, Developing Strategies Principle]**. By the time they face a more difficult task, they have already been successful and may feel more likely to continue being successful (and subsequently keep playing the game).

These "easy" victories play into the concept of "microrewards," where players earn very small rewards which stimulate the part of the brain that craves validation, recognition and so on (Hopson, 2001). It also capitalizes on the notion of "win stacking," where many small successes feed into a larger success (Weick, 1984; Amabile and Kramer, 2011). Both of these mental tendencies (the need for goals to achieve, validation of effort, and the need to feel the potential for success) are also validated in Hattie's research. It's also important to recognize that although these easy victories might seem contradictory to the Challenge Principle (where teachers must provide non-trivial problems to the learner), in the larger scope of the full game (which is very challenging indeed) these early introductions to the game mechanics must be easily graspable and manageable without overwhelming the player **[Learners' Perspective Principle]**.

The fact that the game centers on combat (and conflict) also creates some inherent motivation for the character and (ideally) for the player: they are in danger and must fight (work) to survive. In *Dota 2*, this is true of both the conceit of the game (combat is the core mechanic) as well as the broader narrative (the struggle between Radiant and Dire). Interestingly, very little time is spent on the narrative or "story" of *Dota 2* during these modules; story is often a key motivating factor for many games (tropes such as good vs. evil, or an ally in distress, and so on are common rationales for why the character—and

therefore the player—should care about the game). After a brief mention of the warring factions in the opening tutorial module, no real attention is paid to why they are fighting or what the purpose of defeating the Ancient is. Instead, most of the motivation comes from progression through the increasing challenge of the mechanics and (later on) with personal/social ranking on leader boards and the user's profile.

Orchestrating participation. As a videogame, player participation (in the guise of interaction) is more or less mandatory. In order for that participation to function as learning interactions, however, *Dota 2* uses a number of different features which promote deliberate and intentional participation of a certain kind, ranging from the mandatory actions of the tutorial to the various social "hooks" built into the game.

The tutorial modules again show how the design of the game orchestrates participation. In the second module, for example, the player *must* perform specific actions in order to progress. They must fight the first creep before moving on; they cannot access character info or explore the map beyond a limited range or do much of anything beyond the action (fighting) that the designers want. Indeed, the game goes so far as to remove a great deal of the interface from the player so that they quite literally cannot use it. In this way, the game is promoting some actions and preventing others. Players must act a certain way in order for the game to "approve" their actions and move on **[Where To Next Principle]**.

The entire sequence of tutorial events functions in the same way, ostensibly to ensure that the player has experience with the essential features of the game **[Connecting Experiences Principle]**, although the optional nature of the tutorial means that not all

players are exposed to all features in the same way. The game includes ways of promoting the right kind of play experience (and learning events) even for players who opt not to play through the tutorial. For example, it includes a player "ranking," which matches players of somewhat similar skills, abilities, and play history together (of course, the system is not perfect, and low-ranked players may have a lot of experience with other MOBAs or may have watched *Dota 2* matches previously) **[Challenge Principle]**. Nevertheless, by matching players of approximate skills and knowledge, the game helps to ensure that the new player is not completely overwhelmed by a significantly more skilled player; the new player has more time to explore the game, watch the outcomes of their interactions and play, and to determine if they need to seek help through the tutorial or other teaching site **[Opportunities for Deliberate Practice Principle, Where To Next Principle].**

The Library is another feature where the game promotes certain actions through the video demonstrations of Hero skills. Here the game tries to shape the player's understanding of when and where those abilities are most useful and how they should approach them within a game scenario **[Developing Strategies Principle]**. By showing the player what the skill looks like, the game is providing a model of "correct" behavior; in conjunction with the tutorial levels where many of these skills are introduced in isolation for the player to practice and in "real" game situations, the player has ample opportunities to learn how to be effective with a given ability **[Connecting Experiences Principle, Timing Principle]**.

Finally, the game includes a number of social "hooks" which shape player interaction. Many of the various streaming features, as noted above, have dedicated

spectator chat channels; players are meant to use these to talk to other players independent from the game being played. In other words, these features promote player interactions (which may or may not have to do with the game) while not necessarily interrupting the game itself. Similarly, these social spaces help shape the ways players interact, though not necessarily prescriptively but instead rely on the players themselves to set the tone of what is and is not acceptable (a theme I'll return to more in the next chapter). Valve designed these spaces for participation, but it takes the players to enact it.

Managing attentional economy. Because *Dota 2* is such a complex space, the game needs to constrain what the player encounters early in their play in order to avoid overwhelming them with information. There are currently 109 Heroes, each with 4 special abilities that change as players gain levels, along with hundreds of items, a crafting system, equipment and customization options, as well as a variety of play tactics and combinations of Heroes—in short, there is a lot to learn to play the game. Beyond the concepts of the game, its mechanics and rules, the player must also learn how to operate the interface and recognize what is happening on the screen, itself a potentially daunting amount of information (see Figure 4.1 for an example of the complexity of the on-screen interface). For a new player, even ones who might be familiar with games in general or MOBAs in particular, this can be a lot of information to process. So the game must help ease players into this complexity carefully. *Dota 2* uses a number of ways to help manage the player's attentional economy. Some of which I've already mentioned (like "growing" the interface and sequencing events through the tutorial); here, I want to explore their function in organizing the player's attention and helping shape their understanding of

what to pay attention to and when (i.e. their ability to parse information selectively and on-demand).

At the beginning of the second tutorial module, the game asks the player to move to a certain location. The game uses a flashing green arrow to show where to move, drawing the player's attention to the right spot **[Clear Goals Principle]**. The first three times the player is supposed to move, this green arrow appears at the location (Figure 4.4). Subsequent movements do not include this indicator **[Learner's Perspective Principle, Connecting Experiences Principle]**. This is a very simple example, of course, but it shows how the game can call the player's attention to particular information in a timely manner **[Timing Principle]**. It is designed to help shape how the player understands why that information is useful at that given moment and where it might be useful in the future **[Developing Strategies Principle, Where To Next Principle]**.

The "growing" interface in the tutorial functions in much the same way; early in the second tutorial the player only has a picture of their hero, and as each new skill and ability is learned, it appears on the screen quite overtly—it calls attention to itself and pronounces its new importance. Furthermore, just as the player learns a new skill (and a new action they might take), the game reinforces how to access it (it shows the picture along the action bar) at just the right time **[Timing Principle]**. Indeed, this "growing" interface not only helps highlight or make salient certain features of the interface, it also limits the amount of superfluous or confusing information by quite literally excluding it from the player's view. Only when it becomes necessary (i.e. only when it is useful to the player) does it appear on screen. The game constrains the possible actions the player can

take and the possible information they can process in order to limit the possibility of distraction or disengagement with the complex array of information possible in the game.

Assessment. As I alluded to in the last chapter, games use assessment throughout the interactive sequences of gameplay, often "hidden" assessments of player proficiency or performance (what Shute and Ventura, 2013, calls "stealth assessment). These assessments can be quantitative (how much damage they did, how quickly they performed some task, and so on) although they can also be "gatekeepers" which prevent players from progressing until they demonstrate some proficiency (what we might refer to as tests, and what games often call "bosses"). *Dota 2* uses both kinds of assessment throughout the game, and, perhaps not surprisingly, especially in the tutorial modules.

Consider the movement tasks in the second module which I described above. Not only is the game showing and telling where and how to move, and focusing the player's attention to specific information, it is also gauging if the player can succeed. These moments are acts of assessment embedded into the game. These movement tasks are a kind of gatekeeper; players cannot progress past them without successfully performing the task. If the player cannot move the camera, they cannot send their hero to the right place and cannot move on to the next task. Once they do, they are given the next task **[Where To Next Principle]**. If they don't succeed, the game keeps a record of all the text prompts in the upper left corner of the screen so that players can review the information they have been given **[Timing Principle]**. The game uses a combination of showing and telling to guide the player towards the successful execution of the task, assessing the

success or failure of the player's input, and providing feedback in the form of progression to the next task or supporting material around the current task.

The various mechanics of the game also rely on assessment of a player's performance; they need to do a certain amount of damage to kill various enemies, for instance, and the game must judge whether any given action meets this threshold (it must assess the outcomes of player input). Again, much of this assessment is hidden from the player, or only indirectly evident, but it still forms a core part of the gameplay. Furthermore, whether players know it or not, much of the other teaching acts are designed to get them to "pass" these assessments (i.e. perform to the necessary level of proficiency in combat in order to "succeed" in the game).

There is another function of assessment beyond the player's proficiency, though. Assessment is also about the teacher assessing their own effectiveness, and adjusting to improve opportunities for uptake. As I suggested in the previous chapter, a game like *Dota 2* has gone through numerous revisions and iterations by the time it reaches "market," so that many of the teaching acts and design features have been modified, tested, and revised to maximize these opportunities. The majority of these changes and iterations (based on in-house playtesting and assessment) are never seen by the player base at large. However, *Dota 2*'s nature as a "living" game (where it undergoes patches, modifications, and adjustments as players play it throughout its lifecycle) means that some of these changes are visible to players. Some other living games (like *World of Warcraft*) frequently release patches to fix bugs, change features, or alter the abilities of classes to "balance" the game. *Dota 2* does not patch often, though there have been several major patches to the game. Some of these changes reflect "balancing" effort to

ensure that the Heroes are all competitive, while other changes have addressed deficiencies in game design. It is harder to gauge how much these changes have addressed issues of teaching specifically, although new information and updated information is normally clearly and directly included when the game is patched. Nevertheless, the nature of game design—especially AAA game design like Valve does—is that the designers are constantly assessing if they are clear and effective in demonstrating how to engage the game successfully.

Feedback. Feedback, like assessment, works both directions (to the player and to the designer). Much like the examples of assessment above, many of the examples of feedback rely on providing information to the player about their performance but also information to the designer about how players actually play the game, and how effectively the game supports the players in learning to be successful.

Players get a great deal of feedback from the game about their performance; when they deal damage, the enemy characters flash, and their health bar decreases. When the player takes damage, their own health bar decreases, and the Hero might provide audio cues (spoken phrases indicating that they are injured or in trouble). The game uses multiple channels to tell the player how they are performing.

Similarly, the way players level up and how much damage they do during the matches provides an indicator of how they are doing relative to other players. The game has a number of data-driven tools like level-rate, kill/death ratio, amount of gold and others. These various tools provide some quantitative insight into their performance (if the players are consistently being outgained in levels or have an extremely low kill/death

ratio, it indicated that they might need to revise their strategies) **[Where To Next Principle]**.

Unfortunately, the game itself doesn't offer a great deal of guidance when a player's performance is sub-par; there are not a lot of built in corrective tools. Much of this corrective feedback comes from other players, though continued trial-and-error, and from leveraging outside resources like tutorials, live streams, or theorycrafting sites **[Opportunities for Deliberate Practices Principle]**. Valve has designed a few features into the game to provide opportunities for players to interact and provide feedback; certainly the chat channels in-game are places for players to give each other comments, criticisms, and corrections during the match (although there is no guarantee that players will actually provide useful feedback through these channels). The game does feature something unique in the "Coach" mode, however. A player can invite another player to "Coach" them in a match; the Coach can draw on the player's map, highlight things on the player's interface and action bar, and even direct the player's camera. They also have a dedicated chat channel just for the Coach and player. Again, there is no prescribed feedback in these features, but they are designed to promote this kind of behavior and lend themselves to players' enacted feedback.

Feedback to the designers takes several forms. First, of course, is that Valve has copious amounts of player data (what characters are selected, what actions are performed, what emergent patterns arise) that they can slice a number of ways. Many of the corrections or modifications of a game patch come from careful analysis of this player data (if a certain Hero is being selected at an abnormally high rate, it might indicate an

imbalance that needs to be fixed, for example). This is "silent" feedback in that players are not overtly directing it at Valve but is collected through the "normal" course of play.

Players also can direct feedback to Valve through things like the official forums and the company's service department. Many players use the forums to complain about bugs or to make suggestions to Valve on how to better optimize the game to the players' preferences. Some of these suggestions, of course, may be nothing more than noise (a player requesting a buff or bonus to their favorite Hero, for example), although some feedback may genuinely point out a flaw or feature of the game that Valve had not considered yet.

Finally, Valve undoubtedly spends time in other, "unofficial" channels like YouTube, Twitter, Reddit and other sites where players discus the game in order to collect feedback on player preferences and player attitudes. Like the official forums, these are often places for players to express frustration or speculate on various ideas about the game, although many sites offer a great deal of sophisticated analysis; theorycrafting sites like dotafire.com and liquiddota.com contain detailed analysis of character builds, performance analysis, and complex data modeling. Valve almost certainly watches these spaces closely to get a sense of players' performance and understanding of the game, and uses this feedback to tweak the game's design to better fit their intended goals.

Dota 2 and Informal Teaching

This chapter has tried to argue two important things. The first is that the game *Dota 2* does indeed do a great deal of teaching. I have used the theory of teaching I

developed in the previous two chapters—that teaching is a way of designing good experiences for learning through the use of teaching acts and, ideally, aligned to effective principles of teaching—to show exactly *how* the game teaches. In this way, the way the game design works to organize learning events and the various acts the game uses to teach should be clearer. I have been arguing, in short, that *Dota 2* is a teacher, both in its design and in its actions. I also want to stress that although *Dota 2* does indeed use a number of good teaching principles in its design and in the various teaching acts, it is not a perfect game nor is it a perfect representation; rather, it points to ways in which good teaching can manifest outside of classrooms and model what that teaching might look like. There is always room for improvement, and my use of *Dota 2* is not meant to suggest that it is an ideal solution.

This supports the second claim I have tried to make here and, indeed, have been making more broadly throughout the dissertation: that teaching is not just the province of schools or formal institutions but happen in all kinds of settings by all kinds of people and even many kinds of tools (like videogames). By showing *how* a videogame like *Dota 2* teaches, I hope to illuminate teaching regardless of where it takes place. I have also aimed to give a kind of vocabulary and methodology to looking at teaching in both formal and informal settings. This chapter should, at the very least, show that it is possible to use the theory I have developed to examine a range of activities to see how they do (or don't) operate as teaching activities. Ultimately, I have been making the case that teaching is all around us, and this theory gives us a way of looking at these events and actions *specifically* as teaching without necessarily having to bring the baggage of formal, institutional frames along with it.

Of course, as I stated earlier, many of the examples from the tutorials that I have used in this chapter are highly didactic instances. Indeed, many of these examples don't look too far removed from something we might see in a contemporary classroom, and it is worth noting that I have not strayed too far from the formal, institutional domain of teaching after all. This was on purpose, partly. For one reason, I wanted to pick somewhat school-like teaching moments to show that it is possible to consider teaching outside of the classroom; that is, it's not too far of a stretch to see something that looks a lot like school and formal teaching but in a different setting as "teaching." I also wanted to capture the idea that not all school-like teaching is *necessarily* bad and that instruction—even outright, didactic telling—is a legitimate and potentially effective technique of teaching.

It is most effective, however, when it comes at the right time and in the presence of other forms of teaching as well. This is something *Dota 2* and many other videogames demonstrate so well. For one thing, these instances of teaching acts (showing, telling, assessing and the like) are interwoven in videogames very tightly, as my description of *Dota 2* has hopefully captured. If, as I suggested earlier, the *relationship* between the various teaching acts are important in considering how teaching is happening, then videogames offer a unique and potentially transformational model of teaching. Teaching, acting, participating, feedback, more teaching—all iterating through nearly constant interaction—form a trajectory of teaching and learning events. At the very least, then, a game like *Dota 2* can show us how even didactic, school-like teaching can be more effective through tightly connected teaching acts; it provides a model of what good teaching *looks like*.

But *Dota 2* also suggests something deeper about the relationships between teaching acts and teaching events, and this will be the theme of the coming chapter. By itself, the in-game portions of *Dota 2* offer a rather well put-together set of teaching events designed to provide an "on-ramp" towards learning the larger game. But *Dota 2* is a complex and dynamic game, and no single event, nor even a set of teaching events can teach all of this complexity. So things like the in-game tutorial are an introduction to taking on the larger task of learning to play the game. To support this, *Dota 2* includes designed features that build a network of teaching events that players can customize and experience throughout their trajectory of learning; the game supports a kind of distributed teaching that is somewhat unique in that it blends in- and out-of-game teaching resources together and creates a great many opportunities for learners to customize and modify their learning. I will turn to this distributed teaching in the next chapter.

CHAPTER 6

DISTRIBUTED TEACHING AND LEARNING SYSTEMS IN *DOTA 2*

In the previous chapter, I looked at ways that the videogame *Dota 2* demonstrated teaching acts and aligned to principles of good teaching by looking at designed features within the game, especially the didactic tutorial levels. The emphasis in that chapter was on explicit moments of teaching and the various game features designed by Valve to help teach players how to play the game. The caveat in that argument, however, was that *Dota 2* is a complex game, and that no single instance of designed teaching could possibly cover the complexity it takes to master the game. Indeed, a large part of how a player masters the game is through concerted effort on the part of the player to persist past failure and to maintain an intrinsic motivation to encounter, learn, and master the complex variables of a game like *Dota 2*. The way a player does this is through repeated encounters with the game (including things like the tutorial and in-game knowledge library), but that is only *part* of the way a player masters the game. The other part—which makes up the bulk of the argument of this chapter—is that a player can navigate a *distributed teaching and learning system* and that it is through encountering and traversing this set of networked elements, in conjunction with their continued gameplay, that they learn mastery.

As I argued in the last chapter, *Dota 2* is a well-designed and well executed game, and like many other games includes features like a tutorial and in-game library which are relatively clear instances of teaching. What differentiates *Dota 2*—and what makes it so illuminating in terms of broader themes in teaching—is the way Valve has designed additional teaching "channels" which leverage the affordances of the game client and

work together to teach the complexity of the game. These channels utilize other players as teachers; that is, Valve includes features which are "activated" by other players who perform the role of teacher using affordances of the game itself. For example, the game includes a "coach" mode where a player can invite another player into their game and the "coach" can mark up the player's map, control their camera, and has a dedicated chat channel. *Dota* 2 is made up of multiple designed teaching elements which use the tools of the game to teach (like the tutorial) as well as other "designed-for-emergent" teaching elements which invite players to be participant teachers.

Furthermore, like many modern games, *Dota 2* has spawned a number of emergent teaching spaces like YouTube videos or theorycrafting websites which are outside of Valve's direct designs but which still serve as vital channels for teaching and learning. The relationships between these various designed and emergent teaching systems and the way they work together are especially compelling. These different sites may use very different teaching methods (some highly didactic, some demonstrative, some interactive or based around dialogue and debate), so *where* a learner goes can deeply influence *how* they are taught. A broad view of teaching and learning that considers multiple "sites" of learning suggests something very rich about learning and the many trajectories it may take for any learner, and about the many forms of teaching they might encounter. Perhaps most importantly, because some of these distributed teaching sites are outside of the control of the designer, the relationships between these various sites highlights a tension about who is responsible for teaching and learning—a tension many contemporary schools face with the rise of the internet and other digital media as legitimate sites for learning. Increasingly, learners can customize their experiences and

have more power to arrange teaching and learning sites that suit their interests (for good or not). The ways *Dota 2* leverages many of these emergent sites—but is also subject to those it cannot control—provides an interesting model for how modern institutions (like school) can find a place in a digitally networked 21st-century world.

Distributed Systems of Teaching and Learning

To deal with these complex distributed teaching and learning systems, this article extends a pair of related concepts: Gee's (2003) notion of "big 'G' Games" and Jenkins et al.'s (2006b) idea of an ecology of media and communication technologies. Big G Games, for Gee, include not just the game itself (the code or software or what happens on the screen) but also a range of other activities and sites for participation like YouTube walkthroughs and tutorials, guides and FAQs, web forums, "theorycrafting," cosplay, machinima, fan fiction, fan art and many others. Together, these activities make up the Game, and by considering the many different sites for participation we might gain a better understanding of what playing games really entails. Just as importantly, both designers and players can configure the Game in ways which fit their needs and interests; designers can create robust out-of-game or peripheral activities and sites that support in-game play (and other economically beneficial sorts of things such as "brand loyalty" and social sharing and recommendations which lead to increased purchases); players can similarly organize and arrange their own participation into areas where they feel interested, welcomed, knowledgeable, powerful or otherwise in control of their own experience.

For the purposes of this study, the concept of Games represents something interesting in that no single site is the "game" but rather that the "Game" is made up of arranging (partly by the designer, partly by the player) different sites for different purposes—*it is this arrangement which is most illuminating*. Gee and others (2003, 2007; Gee and Hayes, 2010; Hayes and Duncan, 2012) have referred to these kinds of participatory sites as "affinity spaces," where different people share a passion for something (like a *Pokémon* or *Sims* game, but also things like automotive repair, sewing, science fiction, or even more esoteric things like avocado pit carving), and people engage with passions for the same thing in different ways (some through making videos of their play, some through writing stories about their characters, some through organizing events for other players and so on). Some sites cater to specific kinds of participation (a website for showing off one's custom made cosplay may not offer many opportunities to discuss, say, core game mechanics), so a player can visit one site for one purpose and another site for a completely different purpose. They may adopt different personas at each site (an earnest, helpful participant in a site that fosters that kind of engagement, such as a new player forum; a silent "lurker" on a site centered around detailed statistical analysis of game systems, such as a theorycrafting website; and a sarcastic or playful conversationalist during a game livestream). Similarly, they might adopt different roles or different orientations depending on the site and their relative knowledge and skill, moving from learner to teacher, sometimes even within the same site. The point is that players can customize their experience—choose where and how to participate —and it is through this customization that the Game matters to them.

Jenkins' idea of an ecology of media technologies follows a similar epistemological bent, where the relationships between various media forms and participants and the "cultural communities" (2006, p. 8) which negotiate practices around them serve as a more informative and meaningful way of thinking about media interactivity. Through engaged participation across many different kinds of media, Jenkins argues, people gain not only critical opportunities to participate and "essential" skills like judgement, distributed cognition, multitasking, networking and so on but also a sense of affiliation, expression, and accomplishment. As I'll argue more fully in Chapter 6, these are critical components of taking on the identity of learner and convincing oneself to undertake the difficult challenges in learning. Here, I want to emphasize that participation *across* different media is what makes these characteristics possible, and that people are (relatively) free to arrange them and participate as they choose.

Both of these views—Games and an ecological approach to participation—provide an interesting lens to think about the way teaching happens in and around games, especially a game like *Dota 2* where there are many sites where teaching occurs. Indeed, what is so compelling about these models is that they both hint at a larger view of *where* and *how* teaching and learning happen. If, as Gee suggests, playing games is not just limited to what's on the disk but a whole range of social practices around the game, then we might be able to see teaching and learning as similarly not just occurring in one location or at one time but across a range of different teaching and learning moments. Similarly, if the ecology of these distributed participatory sites is important to engaged participation and a sense of empowered belonging (identity building), and designers and learners can organize and customize these into various networks, then we might be able

to think of teaching and learning as ways of organizing and customizing many different distributed sites for different purposes.

It is no big surprise that no single site or teaching intervention can cover complex subjects. Consider mathematics: where does one learn numeracy or the concepts of arithmetic? It is generally not in one instance but through repeated interactions with the concepts and processes. There may be single teaching interventions which give rise to specific moments of learning (say, a language for addition or for the name of a certain number), but learning (and especially mastery) does not often arise from these single events but when learners encounter content wrapped up in deeply contextual practices. Lave and Wenger's (1991) work on apprentice tailors in Liberia shows how this is often the case, where young learners are repeatedly exposed to the contextual realities of mathematics. Similarly, Nunes, Dias Schliemann, and Carraher (1993) argue that there is a kind of "street mathematics" developed over the course of repeated (contextual) interactions actually using math concepts. Lave's (1988) study of grocery shoppers similarly shows a capacity to learn to use (albeit sometimes without the ability to formalize it into words) math in practice. These and other studies point to different "kinds" of learning (e.g. "street" math versus "school" math).

While there are some important issues about formal/abstract learning and informal/concrete learning (that is, school-like learning gives learners a vocabulary to deal with concepts, to talk about them and manipulate them, to meta-process them and so on at an abstract level, while "street" learning gives learners a chance to actually put the concept into use in the real world and thus a better sense of how the idea fits into their everyday experiences though often with only tacit understanding), I want to instead look

at it from another way. What these and other situated learning studies show is that there are different ways of teaching and learning, done for different purposes, even for the same general concept (like math). If teaching and learning are about organizing distributed sites in meaningful ways, then is critical to recognize not only that there can be different ways and sites for people to learn, but that there are often many pathways into and across learning trajectories; it is the relationships between these parts (sites of learning) and the whole (learning math) that is important to consider.

In other words, these various parts (sites) and the configuration of them (how a learner moves across them) forms the whole of the learning journey (learning math). The relationship between these parts and the whole forms a *system* of teaching and learning. We may be better off thinking about these systematically (that is, how they are related to each other) in order to design more robust opportunities for deep and meaningful learning, to develop critical vocabulary and methodologies for studying and understanding learning "holistically," and to validating and capturing teaching wherever it occurs, in formal and informal spaces alike.

To do so, this chapter returns again to *Dota 2* to consider how the designers create parts of these distributed systems within the game as well as other Game sites that learners can configure as they desire. This chapter looks at *designed teaching systems* in the game (such as the in-game tutorial and knowledge library), *designed-for-emergent teaching systems* (including the "coach" mode and the streaming/spectator mode), and outside-the-game *emergent teaching systems* (especially Twitch.tv and the theorycrafting site Dotafire.com) in order to show how these teaching systems are distributed across the

Game (after Gee's term) and form an ecological network of teaching systems (in Jenkin's terms) that designers and players can customize for their own specific purposes.

Dota 2 and Distributed Teaching and Learning Systems

Chapter 4 described *Dota 2* and made claims about the kinds of teaching found in sites like the in-game tutorial. As I argued in that chapter, *Dota 2* faces a particularly difficult challenge in that it is a very complex game with over 100 heroes, hundreds of abilities and pieces of equipment, and countless potential strategies. The game must teach the player the basic elements (what the goals are, what success and failure look like, techniques to achieve these and so on). Players must also navigate multiple semiotic domains (the mechanics of the game as well as interface elements) so a player needs to learn how to operate both the operational and conceptual levels of the game. To play successfully, they must also learn somewhat abstract strategies for reacting on-the-fly as the game changes through the course of play. Furthermore, because of the highly social nature of the game, there are complex social practices around playing the game that players must learn in order to participate fully in the gameplay experience. These include things like terminology, team composition and strategies, trends in play styles, social conventions and others. Participating in the Game (in Gee's term) requires navigating these social realities as well as the "technical" ones of the "little 'g' game."

The in-game tutorial only covers an almost superficial amount of the actual learning necessary to master the game; it introduces some key features, ones that are absolutely necessary to playing but which hardly account for the deep and sophisticated knowledge it takes to "learn" the game. The tutorial modules are there to *begin* the

learning process for the player, and to shape their initial experience and give them a frame for their continued play, but mastery requires tremendous effort by the player. Of course, it's possible to argue that the joy of gaming is in discovering rules and strategies on your own (Koster, 2004), and no tutorial will completely cover every possible concept fully. It is no surprise, perhaps, that the tutorial is only a starting place.

Valve's unique solution to deal with the complex teaching necessary for mastery beyond the tutorial is in creating other teaching "channels" beyond the explicitly designed ones (such as the tutorial) which include players as active peer- and expert teachers. For one thing, it reduces the amount of work on Valve's part—they design systems which support peer teaching but don't necessarily have to develop all the content to teach, effectively "outsourcing" the labor to the players. Furthermore, in a game that regularly changes through patches, balance updates, and expansions, having a large group of participant player-teachers means that they can respond to these updates rapidly and without the overhead of re-designed "official" teaching interventions. Many players likely relish their role as participant teachers for a variety of reasons, such as supporting friends or other new players and the social cachet it brings, showcasing their knowledge and skills, and even feeling part of the continued development and success of the game. Valve certainly benefits from having players dedicated to the game and engaged in actively introducing new players to it since they will likely continue providing revenue, so including as many teaching supports as possible (through their own designs and through designing tools for players to do their own teaching) is in Valve's financial best interests at the very least.

Designed teaching and learning systems in Dota 2. I use the term "designed teaching and learning system" to refer to many of the overt teaching features of the game; these are what might pass as obvious or common sites of teaching across many videogames, including tutorials, didactic showing/telling, descriptive text, and so on. Most games contain variations on these designed systems, although not all games do. These designed systems are insightful for two important reasons: first, they are intended explicitly by the game maker to perform the function of teaching the player how to play; second, the relative ubiquity of these designed systems across games points to their perceived importance by both game designers and players. *Dota 2* contains several of these designed systems; I will primarily focus on two (the in-game tutorial and the knowledge library) but recognize there are more examples within the game; these two simply provide compelling cases in their own right.

In-game tutorial. *Dota 2*'s optional, multi-part tutorial covers various features of the game, from basic camera and character movement to complex, multi-player battles (essentially, the "real" game). It includes two special modules designed as "testing grounds," where players can play a match against the computer to work through the material they just learned in a safe, low-risk environment. Players can play any of the tutorial modules only after "unlocking" them by completing the previous module, but they can repeat previous modules as many times as they'd like. The game actively assesses the player's performance and acts as a gatekeeper to the player while providing a productive space for players to practice and develop strategies for their play.

The tutorial is broken into eight scenarios, each covering a different topic but also organized sequentially so that the scenarios build on top of what previous tutorial sections covered. This kind of scaffolding is a common teaching technique (see, for example, Bransford et al., 2000 or Pea, 2004) and is closely related to Vygotsky's (1933) concept of the Zone of Proximal Development where learners initially encounter limited affordances in order to reduce cognitive overload or early failure, have the support and guidance of a more-knowledgeable expert, and gradually have constraints removed once they can cope with increasing conceptual or physical complexity in the "real" task they are learning. For example, *Dota 2*'s first tutorial scenario is actually non-interactive, instead containing a 4-minute narrated overview of the basic mechanics and goals of the game. Subsequent tutorials introduce new concepts, from basics like movement and melee combat to advanced ranged combat and high-level knowledge like "last hit" bonuses and equipment management.

The game also scaffolds the kinds and frequency of teaching "interventions," many of which are highly didactic and rely heavily on direct showing and telling. The game tells the player how to do something specifically and directly (such as how to move their character, and points out a spot on the map to move to) and then waits until the player completes that task. Module 2 includes 34 pop-up/dialog boxes, 22 of which include some kind of showing/telling prompt, as well as 7 times where the action "stops" until the player demonstrates competence with the new skill or feature at hand. By the fourth module, there are only 4 dialog boxes and 1 "stop" at the beginning of the

module when it introduces the new concept of starting gear. Within the span of three modules, the teaching interventions drastically drop, and players are mainly practicing the skills they have learned and have demonstrated to the game that they can use them properly.

In-game knowledge library. The game also contains a great repository of information—and teaching—outside of the tutorial modules called the Library. This is another optional section of the game client where players can look up information about all of the heroes (currently 109 of them) as well as items and more (easily several hundred entries). Each character page includes detailed statistical information on their abilities (such as the amount of damage done or the duration) as well as additional narrative descriptions. These statistics provide concrete information for players to use when planning how and when to use various abilities during play (forming strategies for their play) as well as evidence when debating those strategies such as on theorycrafting websites. Players can then use the game as an exploratory space to contextualize that information (to make somewhat abstract statistics meaningful as part of their play experiences). The library is not unlike a "traditional" game manual in that it is a teaching and learning resource that provides background or contextual information that primarily makes sense only when used in conjunction with actual gameplay.

What makes the in-game Library in *Dota 2* different from a manual—and a more explicit teaching resource—is its multimodal demonstrations of character abilities in action. Each ability includes a video showing (modelling) a specific

example of what the attack "should" look like in order to let the player know when the ability works and, potentially, how it should be used (in what situation, against what enemies, and so on). For example, an area-of-effect ability will show multiple enemies surrounding the hero and demonstrate the way the ability damages all enemies simultaneously. This modeling teaches players a great deal about the correct use of the ability, tied to statistical information, and creates a robust link to the actual context a player will use it during their gameplay. The Library can make abstract information contextually meaningful (by showing statistical information that then informs play) as well as make specific instances of gameplay more meaningful by providing additional background information (such as when a player consults the Library to look up how much damage their new ability does).

Designed-for-emergent teaching and learning systems in Dota 2. As described above, Valve has designed a number of systems with the *conditions* for teaching to occur but which rely on players to do the actual teaching. The game itself doesn't teach through any direct design by Valve but through players who "enact" the teaching on their own through affordances of the game client (including interface elements, chat and communication channels, and interactive components of the client). Players are supported (and even expected) to do some of the work in teaching, especially of the various social features like terms, strategies, and etiquette but also more basic gameplay as well. Like designed systems, *Dota 2* includes several different designed-for-emergent systems, of which I will only focus on three. These range across a spectrum of kinds of teaching,

from nearly explicit teaching (the "coach" mode) to implied teaching (the community "build" feature) to a highly emergent channel (the streaming/spectator mode).

"Coach" mode. In "coach" mode, players can invite friends or other players to help them play the game in real time using their own game clients to network together. Coaches can "take over" parts of the learner's game interface (remotely) and control aspects of it. The coach can, for example, make marks on the player's map or action bar that clearly call attention to them and make them salient or relevant, a feature not found in the "normal" game interface. This special mode also includes a separate chat channel for the coach and player to use that no other player has access to; it is a tool that they can use to interact "safely" removed from the view of others. Through this coach/player channel, the teacher (coach) can communicate concepts, terms, and the like to the leaner (player), who can use in turn use it to ask questions and so on.

This designed-for-emergent teaching system is meant to give players both access to a more-knowledgeable peer and to provide specific tools for teaching; while there is no prescribed teaching on Valve's part, they have designed tools which support the teaching performed by players. They have also identified or assumed what kinds of tools are important to perform these functions (interface control, marking and highlighting, a "protected" space for learners and teachers to communicate with less fear of calling attention to the learner's status as an inexperienced player and so on). In essence, they have created special conditions for teaching to occur, though it is up to players to complete the teaching act.

Community character builds and guides. Another way for players to share their knowledge and to teach other players is through the community character builds and guides features. These are interrelated features; the build feature is an interactive tool found in the game client where players can "spec" heroes with different equipment and abilities. They can access these builds within a game and apply it while they play; they can also publish these to the community. Guides are written documents created by players which normally feature builds that other players can import directly into their game, and often also contain a great deal of didactic explanation, meta-level commentary, strategies and suggestions, and even debate through a comment system.

Like the coach feature, these are channels where teaching is meant to occur, though perhaps less directly or explicitly. Valve has built systems where the conditions for teaching are present and provided additional tools that might be used by players such as the interactive modules and the comment feature on guides but which require players to fill in the content and perform the teaching. The guides provide a sanctioned space to share knowledge and teach other players not unlike a forum but with the additional connectivity of interactive tool tips and the ability to "plug in" to the game client. Not all players may use them for this purpose. Some players may only use the build feature to test out various configurations on their own, and so the game allows them to "teach" themselves by interacting with the tool, although this is not a particularly deep level of

learning since the tool is primarily meant to "plug in" to guides or for convenient access during the course of gameplay.

Streaming/spectator mode. Many modern games have vibrant streaming spaces, a feature popularized in part by YouTube and especially Twitch.tv (discussed below). Valve has added an in-client streaming mode which leverages the native interactivity of the client as an additional feature to a "normal" stream site. Players use their own game client to watch matches with the ability to access running statistical information (such as the kill:death ratio and in-game economy) or to change their view to focus on an individual player (including that player's interface), a free-roaming camera, and even to a "directed" camera that is controlled by a commentator. Some streams do not include a commentator, but most professional or semi-professional tournament streams do. Stream channels also have a separate chat channel visible only to other streamers and not to the players.

Players enact teaching in several different ways. In the least direct way, they serve as demonstrations or models through their play; a player can watch the "teacher's" view and interface and follow along with one particular player (even across many different matches) in order to watch an expert make choices, alter strategies and so on. These expert players are teachers in the sense that they model these actions, though they may not even be aware that they serve this role (they may not know, for instance, that someone is watching them as they play); they are, in some sense, "unintentional" teachers. It is often up to the player to

learn by watching (and, hopefully, have some strategy in their own mind as how to learn through this watching). Nevertheless, these player-teachers do a great deal of modeling expert play in action.

Another, somewhat more direct, form of teaching through the stream feature is through commentators. Much like a good sports commentator can break down, explicate, or analyze some part of the game, many *Dota 2* commentators provide a great deal of insight into the thinking of players, descriptions and explanations of the game in action, and "meta" commentary on the game in general. For example, during competitive matches teams take turn choosing and excluding heroes, and often commentators will discuss the choice one team made, options for countering it, strategic planning on what teams might do in their next pick or in their overall composition, and even trends by a specific team or in the game community at large. Most commentators use a great deal of jargon appropriate to the player base and can create or perpetuate these lexical or thematic touchpoints, such as terms for strategies (like a "split push" or "support farming") or locations on the map. Again, these commentators may not directly recognize that they are teachers, but they do a variety of teaching acts throughout the course of their discussion at several levels (discursive, mechanical, strategic, meta). Valve has included interactive features in the client (such as the commentator's ability to direct the camera and a dedicated voice channel) to support commentators and their audience which can be used to teach players about the game in many different ways.

Emergent teaching and learning systems around Dota 2. Many contemporary games include a great deal of Game sites, from lore-based discussion sites to streams to cosplay websites and many others. *Dota 2* is no exception, and is indeed not all that remarkable in the sense that the kinds of activities happening in the Game are not terribly different from, say, *World of Warcraft* or *Minecraft* or *Pokémon*. These are important sites for teaching and learning and play a large role in creating, perpetuating, and changing the Game and the game. It is possible (though outside the scope of this chapter) to consider the various affordances of sites like forums or YouTube, but it is important to at least gesture that these various sites are used differently for different purposes and have different affordances and limitations which influence the kinds of teaching and learning that occur through them. There are many, but I will look briefly at Twitch.tv streams and the theorycrafting site Dotafire.com to highlight a few important threads.

Twitch.tv streams. Twitch.tv is a major site for live game streams, including *Dota 2*. Streams on Twitch.tv are similar to those within the game client except they are generally locked to one individual player's view or on a commentator's screen (it is not interactive in the way the in-client stream is). Many players also include a small webcam video of their face overlaid on the game screen and use a microphone to talk to their stream audience or to other players. Viewers also have a dedicated chat channel to communicate with each other and often with the streamer. Much like the in-client streams, these spaces serve as teaching sites through modeling, commentary, and player communication. Unlike the in-game streams, Twitch often focuses on the personalities of individual streamers and

groups form around popular streamers; here a great deal of social maintenance happens, and these popular streamers often drive community practices by using particular builds, strategies, and terminology (like, names, phrases, or jokes).

Dotafire.com. Dotafire.com is a forum site where players can post hero builds and discuss strategies (among other things) through threaded conversations between many members. Members often engage in a practice known as "theorycrafting" where they formulate complex models of how various abilities relate and work to maximize performance. These discussions, like many of the hero guides, are often quite didactic (take X ability, perform Y action at a given time) in the sense that these players are explicitly telling others what to do and how. Theorycrafting usually requires that the player provides concrete, demonstrable evidence that other players can then test out. It is a kind of "prove it" scenario in which other players can validate a theory to make a more reliable or accurate model. In a sense, theorycrafting is a rich scientific practice that relies on evidence and falsification as a core feature. A website like Dotafire.com also has features which enable debate and discussion as a native affordance.

"Big 'T' Teaching" and Distributed Teaching and Learning systems

So what does this analysis tell us? It shows that teaching happens across a range of events and features in *Dota 2*. Within the game it's possible to see many different channels through which teaching happens, from explicitly designed systems to player

enacted teaching through designed affordances. It also shows that teaching happens in many sites outside of the game (in the Game, after Gee's term) and in support of it.

Perhaps most importantly, this analysis shows the ways that teaching can be a deeply interconnected practice. A distributed teaching and learning system in which various sites are designed, configured, and activated suggests that we may think of teaching and learning more properly as Teaching and Learning (following Gee's term). In the same way that a Game is not just the "thing" on the disc but also many various sites of participation, production, and meaning-making—different sites with different ways of doing things but all part of what goes into "playing" the Game—Teaching could be understood not just as a single site or act but a network of many different kinds of teaching and learning events configured and customized in order to Learn. The configuration of many different sites, the trajectory across many different paths, and the design of many different Learning on-ramps might capture more fully the journey a learner takes and what makes Teaching impactful.

Indeed, an ecological model of these teaching systems could have significant implications. Many studies focus on one feature of a game or one site of learning. We often look for evidence of a moment or an instance of learning (and, occasionally, teaching) at the expense of a holistic understanding of teaching and learning experiences. Even those studies that look for change over time or a progression of learning often limit it to one or two variables. While this might be good practice for quantified study, in many important ways it limits our understanding of the effects of all the various ways (people, things, contexts) that go into good learning. Further research might explore how affordances at different sites change the kinds of teaching acts they use. In particular,

tracing a learner's journey through various teaching and learning sites could uncover important information about the relationships between the various kinds of sites and the kinds of teaching and learning found at each site; it could also demonstrate that it is the act of moving *across* sites that is the valuable part of the teaching and learning transaction. This chapter is also meant to hint that it is possible to conduct traces of specific teaching and learning across various channels and stress the need for innovative research methodologies to follow players across their various learning trajectories or to make large-scale claims about such learning pathways. What I want to suggest here is a way of looking at these various teaching spaces as a collective, as a network of interrelated Teaching sites, and that the distributed nature of Learning is what is most important.

However, part of what makes *Dota 2* so compelling is that it shows that learners have some control over how they encounter and organize their learning within a Teaching and Learning system. It's easy enough to imagine the tutorial as a teaching intervention, where a player learns the basics of the game in a series of events designed by Valve. But that same learner may also watch a YouTube "how to play" video instead of playing the tutorial and learn many of these same things (and others not included by Valve). They also might watch some professional competitive matches and learn a great deal about strategies and hero builds. They could follow-up on these strategies by looking at the in-game build guides. They might then try them out in a match, where they get feedback from the game and possibly from other players about their performance with that particular build, and then iterate in a series of matches to perfect their play or try alternate solutions (possibly after consulting theorycrafting guides or by posting their build and

receiving feedback from other players). They might even be inspired by the game to create some artwork around their favorite character, and dive deeper into the in-game Library for more background on the story or their character's history. They could take this artwork to a fan site and connect to another fan to write a story or a comic around the game, and share not just their passion but their knowledge about *Dota 2*. Further research may validate or complicate this learning trajectory, but this is not a terribly unlikely path through *Dota 2*.

Where in all of this did teaching happen? It happened across a network of distributed, interrelated teaching sites that the player was able to configure in a way which matched their interests and their need for more specific knowledge. They could align the various teaching spaces in a way which supported, guided, and structured their learning as they needed it. This structure was not arbitrary, however. It is partly designed (by the game maker, by the makers of guides or tournaments, and so on) and partly enacted by the player. Valve built their tutorial in a particular arrangement to carefully ease the player into the game; the in-game library provides a depth of knowledge to the player just-in-case and in a way which never interferes with the core gameplay; the community hooks provide a number of "sanctioned" connections to places for players to share, create, learn from, and teach each other. Players can play through these tutorials, though they also have the option of skipping them completely or seeking some other source of information outside of the game.

Other sites outside of the game also design their interventions to guide the player in particular ways: a theorycrafting guide is purposely written to "point to" other sites (through things like hyperlinks) that support their claim (such as a damage meter tool or a

video clip) and to provide further reading (responding to another guide or another site, for example). A YouTube clip might point to the maker's website or to forums where people can critique or offer alternative play suggestions. Indeed, it's even possible to consider the designed affordances of a site like YouTube as part of the Teaching network in that it provides certain affordances (user-uploaded content, comments, hyperlinks, suggested videos etc.). Here, the site which houses the *Dota 2* guide (teaching) is itself part of the *way* it teaches. Though YouTube wasn't designed *specifically* for teaching about *Dota 2*, it still supports teaching, and good teaching can leverage these affordances.

This model also suggests something profound about teaching in general beyond videogames. Through a distributed Teaching and Learning perspective, like the one demonstrated by *Dota 2*, it's possible to think about ways in which teachers can organize networked nodes of teaching, where learners access different teaching acts in different contexts (some didactic, some demonstrative, some hands-on "messing about"). These different nodes can serve different functions towards some Teaching and Learning goal. Admittedly, this may not be too far off of what many teachers do in more "traditional" settings; a science classroom often has didactic teaching moments, course readings, lab time and so on, each of which is serving a different function in the Teaching and Learning network. However, it's worth considering claims about the inauthenticity of these kinds of environments (that many of these activities are not meant to lead to "real" science but to fulfill some mandated competency) and contrast it with games (where generally learning is always aimed at playing the "real" game). We can think of Teaching as designing a system of interactions, building possible connections between various instances of teaching. Teaching creates multiple adaptable channels of teaching and

learning events focused around a concept or complex problem that can be customized to the needs (both those perceived by the learner and those anticipated by the designer) of diverse learners.

In this view, there are many designers, many tools, and many avenues through the Teaching network, a kind of *collective teaching* that accounts for a broader view of teaching and learning, where teachers and learners *co-build* the systems of Teaching and Learning across a range of sites through a broader range of who and what might "count" as a teacher. A game like *Dota 2* shows that tools like interactive pop-up windows or customizable interface objects can be teachers. It also shows the power of peer and participant teachers, where many different people contribute some information or demonstrations of skill or knowledge, often passionately and enthusiastically. It even suggests that teachers don't necessarily have to be "formally" positioned as teachers (a player in a streaming game may never know who or what they are teaching) and yet can still serve as expert teachers if they are connected to learners who can translate watching experts in action into their own play.

One potential afforded by a distributed teaching and learning system—and one problem for an institution such as school—is that control is also distributed and, in many regards, is ultimately left up to the learner. Good designs (such as the kinds of teaching channels found in *Dota* 2) help shape the experience, but players can watch YouTube walkthroughs, talk to other players, and otherwise learn a great deal about the game outside of Valve's control (including things Valve may not want, such as cheats, hacks, or exploits). This perspective suggests that teachers can design and organize *some* of these nodes (in the same way that Valve can design and organize *some* of the Teaching

nodes in *Dota 2*) but not all of them; players/learners have some control and can organize these nodes to fit their needs as described above.

For teachers, then, one opportunity is to leverage Teaching systems (which include emergent or non-sanctioned sites) in such a way as to enhance and support the learner's trajectories. In other words, teachers can plan, design, and organize some Teaching events as well as recognize (and hopefully integrate) other sites learners may utilize in order to create a dynamic and complex system of Learning. It is important to reflect here, of course, that this also implies that teachers are not alone in this process but are integral agents networked with other teachers, learners, tools, and pathways. It is a bit of a double edged sword in this regard—if learners can customize their trajectory, especially through sites and teachers outside of the "control" of a teacher, they may learn something completely unintended by the teacher. It also changes the relationship between teachers, learners, content, and practice.

What Might Distributed Teaching and Learning Tell Us About In-School Teaching?

Ultimately, this chapter is meant to emphasize that something like *Dota 2* is tantalizing in the way it might connect learners to many various knowledges, practices, people, and contexts that transcend one teaching and learning site; that distributed teaching and learning systems demonstrate that it is possible to organize all kinds of learning events outside of the control of any institution at all; and that teaching is not just the domain of schools but can happen in all kinds of spaces, formal and informal.

As I've already argued, one core task of this dissertation is to rehabilitate the role of the teacher and the act of teaching as a key component of learning. Part of this

rehabilitation might be accomplished simply by recognizing that teaching happens outside of school; this makes it possible to consider many kinds of people teachers (parents, peers, designers, and so on). It can also extend the role of teacher to a tool or object (like a game) which opens up new possibilities for designing meaningful interventions with both people and with things, whether in formal, school-like settings or informal spaces. However, since school is the site most closely associated with teaching it is worth considering what kinds of implications a distributed teaching and learning systems model might have for "traditional" school.

Let me make a critical qualification here: I am not suggesting that informal teaching *automatically* does something radically different than what often happens in formal teaching spaces like schools. I do not wish, in the act of extolling informal teaching, to denigrate formal teaching but rather to suggest how to modify it and overcome some of formal teaching's shortcomings by adopting methods utilized in good informal teaching, like that demonstrated by a videogame like *Dota 2*. Indeed, there are a great deal of parallels between them and good teaching certainly *can* happen in school. The sequential nature of the *Dota 2* tutorial modules, and the way it scaffolds instruction around a problem and builds from one concept to the next, is used in all kinds of formal instruction, from arithmetic to grammar to computer programming. However, we often teach these "subjects" as standalones without connecting to practical application (the way *Dota 2* embeds teaching about a particular skill as a discrete action only in relation to the game as a "whole"). It also is true that classes are often networked in practice if not explicitly; students progress from a basic arithmetic class to an algebra class to a calculus class, for example. However, we still often teach and assess these classes as discrete

instances of teaching and learning, and by nature they often are fragmented, isolated, and don't account for previous learning opportunities. It is not the act of scaffolding or of networking classes, but the way they are configured that makes *Dota 2* and games like it so compelling.

Instead, a distributed Teaching and Learning systems approach to school settings suggests that schools are not "alone" in the process of teaching and learning but can be thought of as part of a larger network of opportunities. On the one hand, we might rethink what a "class" is, how it is arranged, and who participates in the acts of teaching. If we consider that all kinds of people and things can teach, and these various teachers can be arranged and activated in particular configurations to support a broad array of learning needs, we might arrive at very different in-school teaching interventions than what "traditionally" passes for teaching in a classroom. Instead of highly segmented, discrete topics and teachers, it might be possible to think of an "affinity space" model which supports all levels and kinds of learning around some designed problem. On the other hand, learners who can organize and navigate complex distributed systems outside of the control of an institution like school challenge how we think about the purpose of school in the first place. Instead of a primary site of public learning, it may become just one of many sites where people go to learn, teach, and participate civically.

Here we can at least envision broadly what networked, distributed Teaching and Learning might look like in school. It might be focused around a complex problem (for instance, the problem of civic engagement, although you could substitute virtually any other problem and slightly alter the configuration). It might include "formal" elements like direct showing and telling (what we might call lecture in school). But these elements

might be connected to many sources, including traditional teachers as well as more knowledgeable peers, and tools like simulations or hands-on applications. It might offer many "paths" through various perspectives based on a learner's preferences and needs (they might be interested in politics and voting, and might want to actively participate in some "politicking" and can then network with other students with similar interests and even "real world" political groups and events; another student might be more interested in the way public protest works and can align themselves around affiliated groups and activities). The role of the "formal" institution (school) would be to design many meaningful paths (in much the same way that Valve "sanctions" some guides or competitive play) but would allow for outside interactions as well (the way independent theorycrafting sites or tournaments operate).

Assessing these interactions contains special problems certainly, and I won't provide (or even possess) many deep answers here. One potential solution is suggested by Schwartz and Arena (2013), who argue that the most meaningful and insightful measurement comes from observing what kinds of *choices* learners make rather than for rote recitation or fact "recall." Though this conversation is outside the scope of this dissertation, I believe it points to the ways school might need to be reconfigured to allow for many more pathways to learning and methods of teaching. *Dota 2* and informal Teaching and Learning systems offer other insights into the orientation of teaching and the tools for measurement which might also drive a rethinking of formal teaching. But in the broadest sense, informal teaching suggests that there are alternatives to "formal" teaching practice, and ones which just might prove more effective and more meaningful

than what currently happens in modern schools. In short, *Dota 2* just might serve as a model for what 21st century Teaching could look like, in all its complexities.

CHAPTER 7

TEACHING AS A RHETORICAL ACT

So far, this dissertation has dealt with the *processes* of teaching, from outlining a set of teaching acts and some underlying good teaching principles. To borrow a phrase from videogames, this dissertation has focused on the *mechanics* of teaching. In this chapter, I want to look at teaching from another perspective and to consider what the *purpose* of teaching is. Teaching is about providing some information or "telling" (as I argued in Chapter 2), but that is not it's only purpose. Good teaching, of the kind I have described throughout this dissertation whether it appears in a classroom, a kitchen, or a videogame, is about building and changing a learner's identity, about creating a new worldview, and about providing tools for continuing on a particular learning pathway that transcends any single instance of teaching and learning and creates a kind of critical self-narrative for the learner. In other words, teaching is about more than transmitting facts, it is about changing minds.

Coincidentally, "changing minds" is also a core function of rhetoric. So too are things like "identity building" and "telling" of a particular kind. Indeed, there is a great deal of overlap between the goals and functions of rhetoric and the goals and functions of teaching, though this relationship is often ignored. This may have to do in part with rhetoric's somewhat negative colloquial connotations, where rhetors seek to trick, deceive, manipulate or otherwise do some kind of harm. As Pullman (2007) colorfully put is, rhetoric is mostly known now for "political lies, corporate spin, long list of Greek and Roman terms for patterns of expression no one knowingly uses, purple prose, boiler-plate arrangement schemas, unimaginative reproductions of bullshit and so on" (16). This

is the “rhetoric” of dirty politicians, bad marketing, and dead academic departments. It is perhaps not surprising that the times when teaching is most closely associated with the themes of rhetoric are claims about teaching as indoctrinating, colonizing, socializing or otherwise doing some kind of nefarious and damaging act to learners (Gee, 2013).

For the ancient Greeks rhetoric, at its best, was one way of forming citizens and civil society around argument and discussion. So, too, many have argued that a core goal of schools is to create citizens, sustain civil society, and prepare students for civic participation in the arguments and issues of the day. Teaching, like rhetoric, is not inherently bad. In fact, good teaching does socialize in a certain way; it shows a particular view of the world and (ideally) the values and beliefs that go along with that view and invites a learner into that perspective. This kind of socializing turns learners into scientists or linguists or woodworkers or mechanics. Claims about indoctrination or socialization often arise when the worldview and values taught aren’t necessarily aligned with those of the accuser, at least somewhat akin to claims about empty political rhetoric when it works to undermine what is good for a “common” voter. That rhetoric and teaching are both politicized (and often negatively so) is not surprising as values are at the heart of both. But focusing on the negative connotations of rhetoric and teaching misses their fundamental nature as world- and identity building practices which are necessary and essential to the “development” of any learner.

The Design of Rhetoric and the Rhetoric of Design

A term, like rhetoric, with a 2,500+ year history develops a long and winding series of meanings, definitions, uses, histories, criticisms, and interpretations (see Bizzell

and Herzberg, 2000, for a succinct account of this history). So it is necessary to both define specifically what I mean by the term "rhetoric" as well as to at least nod to its shifting and unsettled history. This chapter, and indeed this dissertation, is not meant to be a critique of ancient or modern definitions of rhetoric. It is meant to stake some claim about rhetoric (and specifically about some particular form and function of rhetoric) and to show how teaching leverages rhetorical acts as a fundamental component of the teaching and learning transaction.

There is historical precedence for this, of course—teaching and rhetoric have been intertwined phenomena certainly since the ancient Greeks. More modern attempts have been made to disentangle them or to somehow ignore their relationship; see my discussion in Chapter 2, for example, about the movement towards a "science" of teaching and the way it tries to isolate teaching as a procedural activity without considering all of the other social and historical contexts. At the same time, as Black (1992) has argued, "Neo-Aristotelian" studies of rhetoric and rhetorical criticism moved away from discussions or even considerations of the important social and cultural contexts and towards an emphasis on "just" *logos, pathos,* and *ethos*. Both moves serve to isolate and remove the important binds that tie rhetoric and teaching together, for the context of a rhetorical act determines how, why, who and so on, just as the contexts of a teaching act determine the same.

For the purposes of this discussion, I will start with the following definition of rhetoric. Rhetoric is a discursive art centered on the use of language (oral and written language as well as the "language" of visual, aural, gestural, and kinesthetic modes) to motivate and persuade people to act and think differently. It is an "art" in that, while it is

governed by principles and patterns, it is also a practical endeavor that is subject to interpretation and the application of differing methods based on its context of use (by and for who, for what purpose, in what setting and so on). This art is not the static use of a derived formula but the shaping and molding of the formula to specifically fit the given moment. It is, from one particular perspective of the ancient Greeks, a "techne" in that it is meant to produce some effect and not for aesthetic or purely intellectual pursuits (with long, complex debates about things like style and delivery, the use of "ceremonial" language and direct language, the nature of "craft" knowledge and "scientific" knowledge and so on; see Bizzell and Herzberg, 2000, for a more detailed discussion). It is a "productive" act that focuses on some direct or discrete outcome.

Echoing my discussion in Chapter 2 about the "art" and "science" of teaching, rhetoric is also a "science." The basis of this "science" is grammar as an organizing device for language, the mind, and communication. Rhetors persuade by the way they order and style language—in other words, rhetors design the language (oral, written, visual etc.) they use intentionally. From this point of view, rhetoric is a "design science" as much as it is an art. The rhetor must know how to design communication that invites people to think and act in new ways and thus become new and different sorts of people with new values and senses of self. The traditional "canons" of rhetoric are, in large part, about designing the "language" act; *arrangement, style,* and *delivery* are all, in a sense, design choices. These design choices are meant to both fit and create the situation (context) of their use. Using particular words, the pitch and volume of the voice, the use of a dominant color, the mechanic of shooting in a videogame are all chosen specifically (designed) to produce some effect. And, since there is a large body of evidence for how

some design choices "work" (what a word or color evokes to a certain audience, what sense a shooting mechanic gives a player in the larger context of their actions), rhetors can call on this accumulation of evidence (science) to inform their designs. The "art" of rhetoric is not diminished but strengthened by using evidence of its effectiveness, and the "science" is not diminished but improved through repeated practice by rhetors. The "art" and "science" of rhetoric complement each other.

Teaching is also a "design science" as much as an art. Teachers must know how to design communication that invites students to think and act in new ways and thus become new and different sorts of people with new values and new senses of self. As Halliday has argued, the basis of this "science", the basis of all teaching and learning, is "semiosis", that is, language and other symbol systems seen as systemic resources for meaning making. The kinds of design choices described throughout this dissertation used in teaching, like those of rhetoric, are made to adapt to and create the context for their use. Using acts of showing and telling, foregrounding or backgrounding some information, and orchestrating participation all form the kinds of designs a teacher uses, and the various semiotic resources are the vehicles through with teachers enact those designs. And, like rhetoric, the "art" and "science" of teaching are complementary.

All of these designs—rhetorical designs and teaching designs—are productive in that there is some desired outcome. The design (and implementation) is meant to foster some kind of change in the audience. These changes include changes in attitudes, in actions, in beliefs, in values, and in understanding. Both rhetoric and teaching are ultimately about changing the identity of the audience. We do need to face the very real problem that rhetoric can become so easily detached from "truth" and centered on control

and that teaching can so easily become about control as well. Indeed, Bernstein (1996) argued that the "regulative discourse" almost always dominates the "instructional discourse" in teaching in schools. A critical question concerns both rhetoric and teaching: Is the design enticing us to see and live in the world in ways that represent the interests of power, consumption, or the status quo or is the design encouraging reflection and innovation? In both cases, the problem is inherent to the activity and cannot simply be ignored or wished away. In both cases, the answer is to ask not just about knowledge, skills, and truth, but about becoming.

Teaching and the Identity of the "Deliberate Learner"

To think and act in certain ways, people need to accept a change in identity. They need to learn not just to know and do, but to become. To become a "gamer" of a given type is not just to learn to play games, it is to become a certain type of person with certain ways with words, certain styles of interaction, and certain values. To become a citizen of a certain sort is not just to learn to know civics and vote, it is to become a certain type of person committed to certain ways with words, forms of interaction, and values. In the same way, to become a learner of a certain type, ultimately, is not simply to know and do things, but to become a certain type of person committed to new ways with words, forms of interaction, and values. Someone who really understands physics, for example, understands and is committed to certain forms of argumentation and model building as both semiotic tools and as value systems in the search for "truth".

If we accept this conceit (that "becoming" a learner is to change their identity), and we accept the larger premise that teaching is not about transmitting facts but helping

to shape the learner's identity through design, then it is worth asking what *kind* of identity they are building together. From the very terminology it should be clear that identity building and becoming are not one-off or short term transactions but require work and time. It is also apparent that this shift in identity may not happen in any one given instance of teaching and learning but across many different sites and different contexts. And, since good teaching and deep learning are about a mastery orientation, it follows that the learner's journey from novice to expert implies that they will continue along this trajectory and continue to learn and act. In other words, teaching and learning are not isolated events but are fundamentally future-facing.

Since these are future-facing acts, we can return to the question of the kind of identity-building that happens and add this dynamic: that teaching and learning are not just for knowing "in the moment" but for situations "down the road" as well. And, since a teacher might not be there down the road, there is utility in providing the learner with tools to continue on their own. We have already seen, from the good teaching principles derived from Hattie's work in Chapter 3, that good teaching includes Developing Strategies and Connecting Experiences. Both of these teaching principles are meant to show the learner ways to adapt what they know to new situations. Both are also meant to give the leaner tools to learn "on their own" in the future.

One way of thinking about the identity-building that teaching does, then, is as building the identity of a "deliberate" learner, or someone who will direct their own learning. There is a body of literature around things like self-directed learners, especially adult learners (Malcolm Knowles work on adult education being one of the central theories), autodidacticism, lifelong-learning and a host of other related concepts. Many of

these overlap in theory and in practice; most stress the need, for example, of self-reflective practice and in developing a sense of "taste" to know what avenues to pursue. These theories differ in some ways too. They treat the role of instruction as a foundational process for self-directed learning differently, for one; Rancière's *The Ignorant Schoolmaster* (1991), for example, argues that the teacher may need no special knowledge or understanding of a concept in order to teach it but rather a knowledge of how to get *others* to learn for themselves.

The concept of *deliberate learner* that I am proposing here is mostly aligned with these other terms and concepts. I am using *deliberate learner* to mean learners who can manage their own learning, teach themselves, and motivate and persuade themselves to persist past failure and face new challenges. It is this latter feature that distinguishes a deliberate learner from these other terms, and it is also the feature that helps tie learning, teaching, and rhetoric together. A deliberate learner is one who must convince herself that the hard task of learning is worth pursuing. To do so requires self-persuasion. It requires, in other words, a person to practice rhetoric on herself. What teaching does is to help the learner not only develop their own strategies for learning some concept (by tying it to previous experiences and having ample opportunities to practice) but also to develop strategies for overcoming the doubt, fear, and frustration that comes along with the process of learning. Teaching is, as I've argued throughout this dissertation, about motivating, so a deliberate learner (one who is convinced that they should learn some thing) must motivate herself. And, once again, as motivating towards some action is a core function of rhetoric, again the deliberate learner is a self-rhetor, practicing the act of persuading and motivating herself.

No one starts as a deliberate learner; they require teachers, though not necessarily people or things that carry that title in any formal way. There are certainly instances of autodidacts who had little or no formal schooling. But, as this dissertation has already argued, they still encountered forms of teaching outside of school like the structure and organization of books, mentors and peers, and the very designs of the things they studied. These informal teachers helped to build the strategies which allow for deliberate learning by providing good models of how to learn. They have also provided the other identity-building socialization (like how to think like a mathematician or mechanic) on top of the identity of deliberate learner. In other words, these informal teachers show both *how to learn* and *how to be*.

The Deliberate Learner in a Distributed Teaching and Learning System

The identity of deliberate learner is especially important when thinking about the kinds of distributed Teaching and Learning systems I've described in Chapter 6. Part of the argument there was that learners have a great deal of say in how they organize and encounter the various teaching nodes in the system. The risk, of course, is that the learner will not know how to organize it, or use the "wrong" sites, or not be prepared for the teaching event, or not know where to go next. A deliberate learner, in this sense, is actually one who meta-learns (that is, learns about the system of learning they are participating in) how to navigate the system. They will have strategies in place for finding new sites and accessing teachers, and will be motivated to do the work it takes to help *co-build* the system (in the terms developed in Chapter 6).

Let's return to the distributed teaching and learning system of *Dota 2* one more time. Part of the good teaching that happens in *Dota 2* is through the design of the game itself. The game helps motivate players to engage with it and to persist past the complex learning necessary to play (let alone master) by providing many good "on-ramps" to the game (like the tutorial modules). The player may also have some intrinsic motivation (interest in the genre, competitiveness, friends who play and so on). She will convince herself to take on the difficult challenge of learning the game; she adopts the identity of "*Dota 2* player," with all its values and actions. The game gives her tools to enact that identity (the digital "space," the aesthetics, the rules and mechanics). Together (the game + the player), they play *Dota 2,* and the design of the game supports the adoption of that identity as well as motivates the player to continue playing and learning past the designed teaching interventions such as the tutorial. The game promotes continued learning and mastery; it helps foster the player's identity as a deliberate learner of the game.

But, as we've seen, the game is not the only site for learning, and the design of the game can only go so far in helping the learner. The learner can go elsewhere and encounter all kinds of other teaching acts. These other sites, too, are designed to teach the learner facts or information (like wiki or FAQ) but can also be designed to model master-level play (a YouTube tutorial) or invoke discursive practices (a message board or forum) and others. Some of these sites may even be designed to promote continued learning (like the in-game teaching resources) and are also helping to build the identity of the deliberate learner. A good FAQ, for example, will provide links to other "reputable" sites, other just-in-time or just-in-case information, and provide enough structure for the learner to move through the site onto other nodes in the network. Much like the in-game tutorial, a

good site like this points to "where to next" (itself a good teaching principle) as well as provides some sanctioning of another resource. The learner can gain an appreciation of the kinds of information or the kinds of people that are worth paying attention to for when they need that kind of support in the future.

But not all sites are designed in such a way, and not all distributed teaching and learning systems have such clear and helpful paths for the learner. They must make up their own minds about the validity or reliability of a site and develop their own trajectory between teaching sites. Here, the role of deliberate learner is more crucial, as they will have to direct their own progress, meditate on the kinds of teaching events they encounter, and remain motivated to continue building the network of sites they need to learn. This can be a daunting task indeed. The learner must rely on their own past experiences with various sites and techniques and know when to move between sites; they must also be able to recognize when they have reached a dead end or gone down a "garden path" and—perhaps more importantly—how to recover from it. A novice may not have this experience to call on or savvy to know when they have encountered unhelpful teaching.

The internet, being a vast and sometimes very diverse place, includes a certain amount of "trolls," people who intentionally mislead, frustrate, or confuse others for entertainment (and sometimes more nefarious purposes) (Phillips, 2012). Often, trolling is done through the guise of sarcasm and elaborate farce, where outwardly something appears to be a legitimately earnest attempt to explain, communicate, or teach some concept, but those "in the know" (that is, insiders in the discourses of the practice) catch on and recognize the act as satirical. One somewhat transparent example is a thread

posted in the official Steam discussion and guides section for *Dota 2* called “How to be a Russian Dota player” (http://steamcommunity.com/sharedfiles/filedetails/?id=196964525).

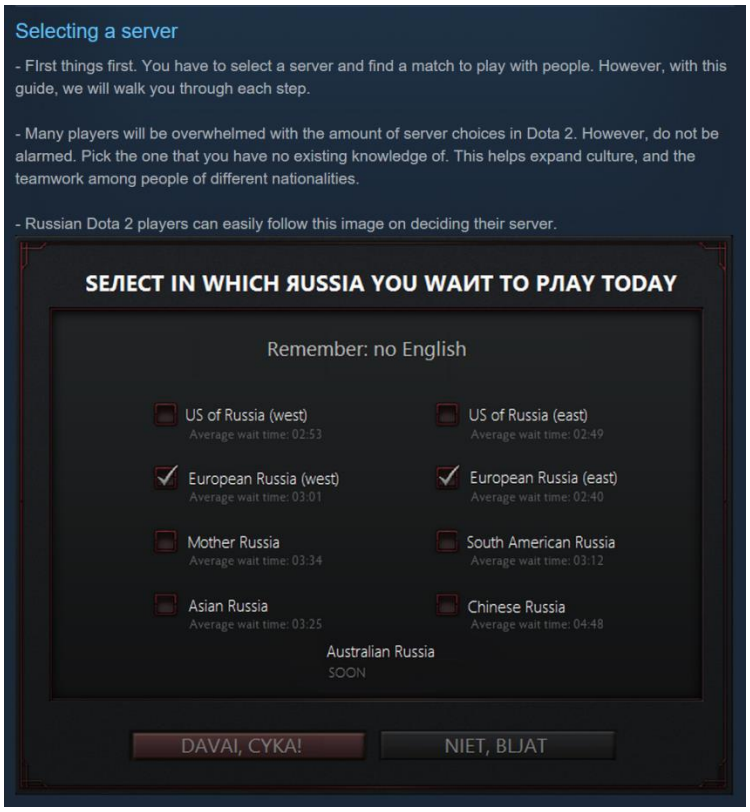

Figure 9. Part of the "How to be a Russian Dota player” guide - note several instances of "trolling" behavior, like the reminder to not use English, or that Russia is "located" on every continent

The guide takes on all the traits of a “real” guide in that it provides detailed descriptions of “what to do,” screenshots and other “evidence” and even comments from other users who ape the mock seriousness of the post. It includes “helpful” instructions such as “If you lose, it is always the fault of your teammates, because they are horrible. Report them to make Dota a better and safer place,” “Break language barriers. Talk in your native language and break the barrier between Russian and other languages,” “When your teammates are using a courier, reuse it to use your items, and send it to the enemy base.” Any even marginally savvy person will recognize the first tip as somewhat

ridiculous (and meant to both betray the joking nature of the post as well as cue insiders into this common behavior in game—this joke works on several layers). The second hint is less obviously "trolling" and could, in the right circumstances, actually be a helpful way of bringing diverse communities together through networked systems like a videogame; but it still belies the ridiculousness of speaking in languages other teammates won't understand. The final hint, however, requires a great deal of insider knowledge of the game; a new or novice player likely won't understand that using the team courier in this way is both bad form (frowned upon by the "community" of *Dota* players) as well as detrimental to their team's success since the enemy can kill that courier and hurt the other team. Read by a novice, they may actually think this is a helpful tip; a young *Dota 2* player searching for "tips and tricks" for better play may stumble across such a post and, lacking a well-developed sense of sarcasm, may actually read and enact the hints given in it.

I have picked a somewhat obvious and egregious example of a "troll" guide to make it very clear how these kinds of posts work; other examples are far less clear and may truly look like helpful posts. As a somewhat tangential example, a common "helpful" tip trolls gave for people trying to repair their computer is to delete a registry file called system32.dll, a critical file that Windows cannot work without; the trolls write a convincing post or message to the user looking for help and make it appear that this is an effective solution (http://knowyourmeme.com/memes/delete-system32). When the user actually does this, however, they render their computer inoperative. Here, the trolling is as opaque as possible (unlike the clearly comical example from *Dota* that I've provided). The point is, troll posts can be designed to mimic "legitimate" teaching acts,

and learners must be wary enough (experienced enough) to understand how reliable a source is; the identity of deliberate learner, one who is experienced, motivated, and meta-reflective is essential when creating the network of teaching and learning sites made possible through modern digital media in order to both create an effective distributed Teaching and Learning system as well as to minimize the effects of potentially unhelpful or detrimental nodes.

Game Design, Rhetorical Design, Teaching Design, World Design

There is one other important way of thinking about the implications of teaching as a rhetorical act. Because rhetoric and teaching are both "design sciences", it is important to see their connections to modern forms of design in the digital world, such as game design. "Digital literacies" are, like traditional literacies, ways of producing ("writing") and consuming ("reading") meanings and, thus, based on grammars of intent and semiosis as systemic resources for meaning making. These grammars and semiotic resources are design tools which help build new ways for humans to act and interact. In game design, these tools are used to quite literally "build" spaces for players to act within, build identities for players to assume and challenge, build mechanics to act with, build limitations and affordances for those actions, and build channels for players to interact with the systems of the game and even other people. Like teaching design and rhetorical design, game design is about building worlds and building identities.

Throughout this dissertation, I have emphasized the similarities between teaching and game design. Chapter 3 explored the design of Deus Ex and drew parallels between teaching as a design act and the design of the game. Chapter 4 outlined a set of teaching

acts and aligned them to examples from games. Chapter 5 developed a set of good teaching principles and looked at the way a specific game, *Dota 2,* demonstrated those principles in action. Chapter 6 looked at the way teaching and learning span across many different distributed sites and the way a game design can leverage the affordances of such a network. I have attempted to show that games can teach, can be good teachers, and can tell us something about teaching in general.

In the final part of this chapter, I want to focus on the other kinds of work games can do and how that aligns with the kinds of designs described above about rhetoric and teaching more broadly. That game design is rhetorical is not a huge leap—Bogost (2008) has argued for the kinds of ideological and procedural rhetorics of game design for almost a decade. Game design invites players in to the worlds, roles, and characters and set players up to act in certain kinds of ways. Game design creates the situations and the rules that govern the kinds of actions players can take (though players can resist, as Gee has argued, through the "projective" role of the player's own desires, goals, and values enacted through affordances in the gameplay). Game design creates "win states" and determines who "succeeds" and who "fails." Videogame design can be dictatorial.

Game design also fosters a kind of rhetorical alignment of identities (what Burke [1969] might call "consubstantiality") by positioning the player to necessarily come to see their on screen counterparts as "part" of themselves. In the most mechanical sense, gameplay requires a player to inhabit the in-game representation of herself. Narrative flourishes can help (or hinder) the depth of this consubstantiality, but the procedural and interactive nature of a game presumes that the player will act "with" the game. This is the kind of "procedural rhetoric" Bogost describes and, as he claims, what makes games

unique among other kinds of media—games need the player to "play along" and their very design ensures that they will.

But good videogames also build worlds, worlds in which players experience something new about themselves and about their own relationships to the "everyday" world. Like teaching, and like rhetoric, game design begs a certain fundamental question about the *kinds* of worlds they build. These worlds are ideological worlds, and playing the game entails interacting with these ideologies. How the game invites a player to see the world is just as important as what that world looks like; a game which takes place in a modern urban setting will contain certain aesthetic and representational choices; it will also contain some kinds of choices about how power, control, and opportunity might be represented. This is "world building." But how the games places the player, what kinds of actions and expectations are put into place for the player are also just as telling. Are they the corrupt cop, the disillusioned suburban teenager, the abandoned and homeless military vet? Each is positioned differently to the issues of power, control, opportunity and so on. Putting a player in one position reflects some expression of the underlying ideological values of the game and the game's designer. *How* the game sets up the relationship of what the player is supposed to do within the larger world is a critical part of understanding how games build worlds and build identities for players.

Games are not just limited to the worlds and identities they create as part of the game, however. As this dissertation has stressed, a game is part of larger social and cultural practices, ones which extend far beyond the screen and into the player's everyday experiences. Players who play a game like *Dota 2* are connected to the fictional gameworld (what happens on the screen and the underlying narrative elements), to their

physical environments (through interacting with the controller and the broader technological systems like computer systems, electricity and so on), diverse social interactions (in the game, with peers, with strangers on the internet, though various mediated channels like forums and Twitch streams), to commercial realities (purchasing software and related products), and many other interrelated systems. Playing the Game (in Gee's terms) means that the game extends deeply into the "real" world as well as what's on the screen.

So, too, can the kinds of worlds and identities games help to build. The way in which rhetoric, teaching, and game design are united as forms of design for becoming is seen clearly in the ways in which, thanks to digital media, teaching and learning have moved from school to popular culture outside school. In popular culture today, affinity spaces cannot coerce people via institutional control to enter and learn. They must invite people to become, for example, "modders and designers for *The Sims*" through the forms of participation, agency, interaction, and resources they have to offer. They must kindle interest and then blow that interest into the fire of passion if they are to capture people for the thousands of hours of practice to learn to do and be a "modder and designer for *The Sims*". Rhetoric, teaching, learning, and design of all sorts has been set free from institutions and turned loose into a market place of ideas and sites offering new forms of participation and agency, new ways of being in the world. In the face of this market place we need to develop new tools for analysis that will center on discussions about who we want to be, who we want others to be, and what world we want all of us to live in. These discussions will center not just on "truth", but on values as well—which is exactly where, in a high-risk imperiled world, they should be centered.

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