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From Simulation to Imitation: Controllers, Corporeality, and Mimetic Play

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Abstract

Background. We contend that a conceptual **conflation** of **simulation** and **imitation** persists at the heart of claims for the **power** of game-based simulations for **learning**. Recent changes in **controller-technologies** and gaming systems, we argue, make this conflation of concepts more readily apparent, and its significant educational implications more evident.

Aim. This article examines the evolution in controller **technologies of imitation** that support players' **embodied competence**, rather than players' ability to simulate such competence. Digital **gameplay** undergoes an **epistemological shift** when player and game interactions are no longer restricted to simulations of actions on a screen, but instead support **embodied imitation** as a central element of gameplay. We interrogate the distinctive meanings and affordances of simulation and imitation and offer a **critical conceptual strategy** for refining, and indeed redefining, what counts as **learning** in and from digital games.

Method. We draw upon **actor-network theory** to identify what is **educationally significant** about the digitally mediated learning ecologies enabled by imitation-based gaming **consoles** and **controllers**. Actor-network theory helps us discern relations between **human actors** and **technical artifacts**, illuminating the complex inter-dependencies and inter-actions of the socio-technical support networks too long overlooked in androcentric theories of human action and cognitive psychology.

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Conclusion. By articulating **distinctions** between **simulation** and **imitation**, we show how imitative practices afforded by mimetic game controllers and next-generation motion-capture technologies offer a **different picture of learning** through playing digital games, and suggest novel and productive avenues for research and educational practice.

Keywords
actor-network theory, consoles, controllers, digital games, education, embodied competence, game-based learning, imitation, learning, learning environments, mimesis, play, simulation, technical artifacts

The question of what and how players are learning in and through digital games has been at the forefront of research on education and gameplay over the last several years, beginning with studies of what and how people learned from playing commercial/entertainment-oriented digital games. Initially repudiated as artifacts of an "unpopular culture", particularly by educators and educational theorists, commercial video games are, today, being increasingly studied (and developed) as potentially effective learning environments in which player/learner agency is paramount, and where, in contrast to the prescribed educational tasks so often resisted by reluctant learners, the acquisition of knowledge and competency is enacted through engaging and pleasurable play, and realized through game-based challenges (de Castell & Jenson, 2003, 2005; Rieber, 1996).

This article considers how new controllers, as technologies of imitation, might directly support players' embodied competence rather than players' ability to simulate such competence. We contend a conceptual conflation of simulation and imitation has persisted at the heart of claims for the power of learning through game-based simulations. Recent changes in controller-technologies and gaming systems, we argue, make this conflation of concepts more readily apparent, and its significant educational implications more evident. Interrogating and differentiating the distinctive meanings and affordances of simulation and imitation, we argue, offers a critical conceptual strategy for refining, and indeed redefining, theories and practices of digital game-based learning (as well as for rethinking practical approaches to the development of educational games and play-based virtual environments for learning). Below, we examine a relatively recent shift in game information systems and controllers to point out a corresponding epistemological shift in which gameplay becomes not just the *simulation* of actions on a screen, but enables embodied *imitation* as integral to digital gameplay.

A central question for education in the 21st century is how best to prepare young people to act and live in a complex world that is constantly remediated through the use of technologies: How best to act within a network where not only other human actors are present and in play, but where technologies (digital artifacts) are also significantly present, are acted upon, and in action. Working in the field of science and technology studies in the 1980s, Michel Callon and Bruno Latour developed a theory that insists on the agency of humans and non-humans working together, both materially and semiotically. Actor-network theory (ANT) elucidates the relationships among human actors and technical artifacts, illuminating their inter-dependencies, their inter-actions, and the encompassing socio-technical support networks that have been too long overlooked in androcentric theories of human action (Latour, 2005). That said, ANT has been criticized for lacking a political framework, as it "flattens out" differences and hierarchies (Alcadipani & Hassard, 2010). However, given that technologies have taken on a greater and more inter-dependent role in the lives of young children and adults alike, ANT offers a productive way of untangling and understanding their threats to, and promises for, teaching and learning in the 21st century. Turning to games specifically, ANT's application to digital games was helpfully conceptualized by Seth Giddings (2007) as "playing with non-humans." Here, Giddings stressed that play in digital games primarily means playing with interactive game systems, and not necessarily with other (human) actors.

In this article, we explore socio-technical relationships between and among game players, games and new gaming controllers, following Giddings' lead in using ANT as a means to study some of their complex articulations. We tease out of that exploration a critical conceptual distinction between simulation and imitation, and indicate how this distinction illuminates an understudied transformation in digital game-based learning brought powerfully into play with the emergence of a burgeoning variety of new game controllers, innovations, we argue, having particular value and importance for educational applications of digital game-based learning. Drawing on educational philosophy and aesthetic theory, as well as foundational work on simulation games and gameplay, this article is first and foremost conceptual, attempting to elucidate educationally salient differences between simulation and imitation and, by implication, to explore significantly different modalities of experience, agency, and learning with/in digital games.

Just Playing?

Digital game-based learning is an increasingly important area of study for games researchers, spanning the "serious play" areas of health, science, math, second language learning, and so on (Barab et al., 2009; Hsu & Wang, 2010; Ke, 2008a; Tobias & Fletcher, 2012; Tobias, Fletcher, Dai, & Wind, 2011; M. F. Young et al., 2012). A central question researchers have asked is, while playing, or through play, what might players be learning and how are they learning it? Often, that inquiry has met with mixed results, as recent reviews of educational game-based learning attest—with some arguing that evidence for learning is clearly discernible (Sitzmann, 2011; Tobias & Fletcher, 2012; Tobias et al., 2011), and others arguing that little to no evidence (yet) supports the case that games are, or even can be, viable sites for learning (Ke, 2008b; M. F. Young et al., 2012).

For the purposes of this article, we argue that the difference evolving controller technologies have made to who can play and what (and how) players can learn from games, is of particular interest in relation to demographics of game access and use. This game-changing evolution in gameplay controllers (from the classic controller to the Wii wand, Microsoft KINECT, plastic guitars, microphones, sports equipment, plastic drums, and beyond) invites and enables *imitation*, a form of learning traditionally relegated to the very young (Piaget, 1962) as the central element of gameplay *for all*.[1] Controller-based modifications of the way games are played might productively be seen as a kind of paradigm shift from *simulation* to *imitation*, one that has already attracted new audiences to digital gameplay and significantly shifted player demographics, prospectively changing the landscape of digital game-based learning. Whereas a decade ago, Holland, Jenkins, and Squire (2003) saw the requisite robustness of simulation tools as an obstacle to accessibility for new users, Juul (2010) argues that more recent innovations in controller technologies and *mimetic* games like the Nintendo Wii signal a "casual revolution," inviting new and diverse audiences to digital gameplay.

For example, in 2007 and 2008, the Wii outsold both the XBOX and the PS3 consoles, and in 2010, it still had approximately 49% of the console market (Yoskowitz, 2010). As of December 2013, the original Wii had sold more than 100 million consoles worldwide (Patterson, 2013) and the Microsoft KINECT has experienced similar commercial success, even claiming sales records for the "fastest selling electronic consumer device" (Stevens, 2011). Meanwhile, Microsoft is patenting motion-capture systems to extend KINECT-like features to a wider array of devices, including tablets (T. Lee, 2014), and researchers like Kajastila and Hämäläinen (2014) are applying the KINECT platform to novel game challenges (like rock-climbing). Inconceivable a decade ago, these digital game systems are, today, increasingly to be found in long-term care facilities, senior centers, and retirement facilities. In Japan, by the summer of 2007, female players accounted for half of Nintendo Wii players, and in 2008, the Queen of England declared that she was a fan of the Wii (Cavalli, 2008). In the United States, Canada, and elsewhere, seniors' homes purchased the Nintendo Wii (with its suite of sports and fitness games) for residents' exercise groups (White, 2007; Yam, 2007). In North America, most recent figures published by the Entertainment Software Association (2013) declare approximately 45% of adult players are female. The initial success of the Wii was based on claims that it was indeed reaching a different player demographic, including women and seniors, as well as "first-generation" digital game players who are, thanks to games like the Wii, now returning to digital gameplay (Cavalli, 2008; Juul, 2010; Schoenberger, 2008).

More than ever, it is obvious that playing games is not a solo act (Simon, 2007): Players are both acting and acted upon by the technology, and their play is very much situated within a broader network of actions, actors, and activities that are at once community-based and materially supported (Taylor, 2003, 2006, 2009). By taking account of what Latour (2005) calls "non-human mediators," it is possible to draw attention to how innovations and emerging media *act upon* players, and thus to (re) examine how these novel affordances support both play and embodied learning, as well as the participative agency of new and diverse audiences.

"Learning Principles" and the Question of Transference

In his early work on how players learn from video games, James Paul Gee (2003) went so far as to specify a series of learning principles that commercial video games instantiate. Learning in video games, Gee argues, is accomplished not through the delivery of content, propositionally conceived, but that meaning and significance arise through the player's activation and skillful negotiation of images, objects, events, and so on, in specific situations of challenge. Gee encourages educators to imagine similarly principled forms of "good teaching," where everyday learning experiences incorporate ludic forms of engagement and challenge-negotiation.

Alongside their ability to contextualize meaning through player agency and exploration, video games also, Gee argues, provide good models for understanding the thorny and long-standing educational problem of *transfer-of-training*, where solutions to an earlier problem require modification in the face of a new challenge, or where capacities acquired within one environment are applied to a different setting, or to another set of challenges. Transfer, Gee explains, requires that learners identify the similarities and differences between two sets of circumstances. In addition, while schools surely aspire to structure the curriculum so students can apply lessons beyond their original pedagogical conditions of acquisition, such direct transfer, argues Gee (2003), rarely happens in "real life."

Video games, however, *excel* at offering a range of circumstances that call for the retrieval and continual updating of previously learnt strategies, and for critically applying increasingly sophisticated competences (as acquired either from the same game or, just as importantly, from other games), in order to move on in the game (Linderoth, 2012). That these challenges are often framed as urgent life-or-death situations, and as the consequences of a poorly modified strategy are often immediate, players must reflect on, and innovate upon, previously learned solutions "on the spot" (Gee, 2003). In terms of the transference question, then, video games might support transfer, where players are able to engage and improvisationally test one learning challenge through the lens of another interface, medium, situation, or (game) environment. For example, in some of the games and learning literature that focuses on the acquisition of traditional literacies, learning (and learning transfer) is studied as *incidental* to gameplay. Several researchers (Hsu & Wang, 2010; Salen, 2007; Steinkuehler, 2007; Walsh, 2010) report how students master competences in and through dynamic game-based challenges, where what is learned is an incidental co-efficient of sustained play. Steinkuehler's work, which has focused on what players learn through playing Massively Multiplayer Online Games in particular, highlights those traditional literacy demands (reading, writing, posting comments) involved in gameplay, including the "higher order" reasoning skills that are publicly displayed by experienced players (Steinkuehler, 2006, 2007; Thomas & Brown, 2007). Significantly, Gee's (2005) theoretical work suggests that what is most compelling about commercial video games, and thus so valuable for educational research, is that these games invite, and successfully induct, players into specialized, higher order discourses, where diverse literacies are acquired within the context of gameplay. This kind of sustained engagement with/

in (multi)literacy practices incidentally afforded by digital games speaks eloquently to one of the most significant challenges confronting traditional forms of instruction and schooling: The problem of student *dis*-engagement has reached crisis-like proportions. Finding ways to address this issue now tops the priority list for schools, colleges, and universities the world over.

Voluntarily, by choice and just for "fun," players of an older simulation-based game-like TONY HAWK (PRO SKATER versions), just by gaining enough skill to succeed within the game, develop familiarity with both the specialized moves and the specialized language that constitute skateboarding, whether or not they have actually skateboarded. In other words, a player can advance, through progressive simulation of a skilled practice, from knowing little more than that skateboarding involves a skater and a board, to mastery of a semiotic domain in which she is able to discuss, think, and learn about, and generally share, a culture of skateboarding (even with those who are professionally trained) and all by playing a simulation-based video game.

Note here the important differences between conventional lesson-based modes of *teaching* a specialized discourse and, by contrast, *learning* it as voluntary practice. It has been argued (with considerable money, both public and private, invested in that argument) that, beyond building propositional knowledge *about* skateboarding, physical skills and know-*how* can also be acquired through simulated play in a range of video game–based sports environments (Papastergiou, 2009; Sell, Lillie, & Taylor, 2007; Vernadakis et al., 2012). The controversial argument has been advanced that first-person shooter games both can and do support the development of highly accurate weapon skills (Grossman, 2000). Such examples of potential transfer-of-training outcomes have in turn challenged game researchers to design compelling educational games that might move someone from novice to expert status, not in the worlds of skateboarding, piloting, or warfare, but in formal school subjects such as history, mathematics, the arts, or sciences. This design-based research practice veers away from commercial games, attempting to design games that are both fun to play *and* educational (Ciavarro, Dobson, & Goodman, 2007; de Castell, Jenson, & Taylor, 2007; DiPaola & Akai, 2007; Droumeva & Wakkary, 2007; Levy & O'Brien, 2007; Watters, 2005). Significant from an educational standpoint is that digital games are in this case understood as more and other than entertainment: They are studied as artificially intelligent spaces for transferable learning where people engage complex challenges, collaborate, problem solve, read, strategize, communicate, participate, and act together—both inside and outside the game and its formal rule structures (Tobias & Fletcher, 2012; Tobias et al., 2011). However, can both *know that* (propositional, representational, and informational knowledge) and *know-how* (skilled doing, embodied performance, non-propositional attitudes, and practical dispositions) be learned through simulation games?

Simulation to Imitation: From *As If* to *Just Like*

Until relatively recently, digital games were customarily played in one of two ways: A single player sitting at a desk in front of a computer screen using the keyboard/mouse/

joystick as input devices, or by sitting around a screen (originally a television) and using a gamepad/controller to interact with the game and, through the game, with other players. In both cases, the technology required the player to press keys and/or buttons, or move a mouse, and that player action was "translated" into an on-screen simulation of the action by the player's character/avatar. For example, in order to make Mario jump over the cartoonish mushrooms in SUPER MARIO BROS., a player would press the correct button (either on a keyboard or on a controller) and Mario's simultaneous corresponding action would be to jump. In this way, the action of jumping (or walking, running, shooting) is a simulated act that is synchronized with the correct input cues from the player. Within this simulation environment, the relation between the player's actions (*press A*, for example), and Mario's jumping is a semantically arbitrary one. A button press is the technologically mediated means to the avatar's jumping, but that player action is itself nothing like the jumping, nor does it model jumping, whether in its dynamics or in its structure (Humphreys, 2004). A button press bears no resemblance to a jumping event. Button pressing is the action whereby jumping is simulated, and by simulated jumping we mean, with respect to the player's action, a kind of *as if* jumping. The player presses a button, and it is *as if* the player made that character jump. Here, we discern an abstract relation—a morphological disconnect—between a player's action and what her avatar does in the game.

Not insignificantly, in the past few years, input and motion-capture devices have changed considerably in ways that have resulted in a very different form of gameplay, instating a very different relation of player action to game event, as well as inaugurating very different socio-technical relations of player(s) to controller, screen and information system, and to other players or spectators in immediate, or mediated, play environments. Seen from the standpoint of actor-network theory, these ecological changes may greatly alter how we understand, design, and use digital games for education. To develop this point, we next examine simulation games in general, and then more specifically, emergent games and technologies that support *imitation* (by which we mean, fundamentally, mimetic activity).

Simulation games, such as flight simulators, racing games, and exercises like SIMCITY, are widely acclaimed as effective training environments: race car drivers practice "real" race courses in video games (Doerr, 2008), medical students practice surgical and nursing techniques (Lane, Slavin, & Ziv, 2001; Rauen, 2004; Rothgeb, 2008), pilots train to fly (A. T. Lee, 2005; Robinson & Mania, 2007), and for centuries, war games were simulated to train for battle (Smith, 2010). Simulation games have most typically had two intersecting goals: a simulative experience that is as real (*as if*) as possible, and a goal-based play experience that is as engaging as possible. Myers (2003) suggests, however, that in this tension between "realism" (as if) and "play" (sustained engagement), the real in digital games often gives way to entertainment in ways that diminish the educative possibilities of *as if* simulation games. As Apperley (2006) further contends,

> Within this [discussion on simulation games] is often the assumption—or the promise—that the game is "authentic" to the "real" activity, that the game will be a relatively

> accurate simulation, which does not subsume the authenticity of the simulation entirely within the demands of entertainment. (p. 12)

Key here is the educational promise of a simulated "real-world" experience, one that engages the user through play. Yilmaz, Ören, and Aghaee (2006) are even more direct, stating,

> Simulation has two meanings: (a) imitation and (b) goal-directed experimentations with dynamic models (Ören, 2005). Simulation games are used for entertainment and for training purposes. The role of simulation in entertainment games is to provide real-ism. In this case, simulation denotes imitation of the intended world, real or imaginary. (p. 340)

On this view of things, simulation games have, through their putative "imitation of the real," traditionally attempted to simulate behaviors and attitudes in the "real world" (Williams, 1980). In that same vein, a recent comprehensive review of the philosophy and epistemology of simulation (Grüne-Yanoff & Weirich, 2010) begins its extensive and otherwise sophisticated conceptual analysis with the assertion that "to simulate is to imitate or replicate . . . " (p. 24). They go on to quote Hartmann who states, "A simulation imitates one process by another process" (cited in Grüne-Yanoff & Weirich, 2010, p. 24).

Not all representation need be imitative, however, and we argue that simulation and imitation are, and need to be, recognized and treated as distinct concepts.

In an emerging field as dynamic and innovative as is digital games research, it is understandable that foundational conceptual work might initially get overlooked. That said, early theoretical oversights can have enduring consequences, and we argue that a foundational, but enduring, conceptual conflation of simulation and imitation has become increasingly evident in novel digital-gaming ecologies. In what follows, we excavate what we see as a critical conceptual weakness in the ways game studies has understood simulation, a foundational concept on which much current theory, research, and practice around learning-through-games is built.

What *is* overlooked, then, in the conflation of simulation and imitation? Imitation, referring necessarily to mimetic activity is, as we have seen above, often subsumed in digital games research within the category of simulation. However, by critically prying these two terms apart, we can more clearly discern in the conceptual nuances of this distinction an under-theorized promise for game-based educational technologies in general, and for responding to education's central challenge of transfer-of-training in particular.

Stepping back in time to get our bearings, we note that it has been largely through the imitation of attitudes, behaviors, dispositions, and discourses that people have been thought to be both socialized and educated (cf. Rousseau, 1762/1979), and it is through their achievement of successful imitation that we most often recognize people as having learned something. Imitation has a long history of theorization, stretching back to early Greek culture where mimesis (imitation) was understood to be a form of representation. While for Plato, mimesis was a deterrent in the search for authenticity or the "real" (Sullivan, 1989), for Aristotle (1998), mimesis is

> inherent in man [*sic*] from his earliest days; he differs from other animals in that he is the most imitative of all creatures, and he learns his earliest lessons by imitation. Also inborn in all of us is the instinct to enjoy works of imitation.

Aristotle argued that mimesis was central to our understanding of the world, and as Puetz (2002) explains,

> Mimesis not only functions to re-create existing objects or elements of nature, but also beautifies, improves upon, and universalizes them. Mimesis creates a fictional world of representation in which there is no capacity for a non-mediated relationship to reality. Aristotle views mimesis as something that nature and humans have in common—that is not only embedded in the creative process, but also in the constitution of the human species.

It is not within the scope of this article to provide an extensive overview of theories of mimesis, nor to recount the extensive body of research to date on simulation, imitation, and education (for literature reviews, see, for example, Australian Learning & Teaching Council [ALTC], 2008; Kirriemuir & McFarlane, 2004; Sauvé, Renaud, Kaufman, & Marquis, 2007). Our present intent is principally theoretical: to argue that an evolution in game systems, controllers, and interfaces requires and enables us to make a key conceptual distinction between imitation and simulation, and we call attention to some significant implications of this distinction for game-based education that have yet to be fully explored. Lending support to that argument is notable work on mimesis by theorists such as Walter Benjamin (1928/1973, 1968) and Theodore Adorno (1984) that helpfully underscores the importance of understanding representational forms (poetry, art, and language) as fundamentally inseparable from the real. For Adorno, acts of imitation do not simply make mimetic copies of the world, or reflections of reality; rather, mimesis is an engaged process of adapting to, mediating and re-mediating reality and world. Unlike *as if* simulation, mimesis signals a more immediately haptic and embodied relation to practical challenges, processes, and real-world techniques of making and doing. Mimetic activity does not simulate the real, Adorno argued, but is inextricably engaged within, and is thus an inter-active constituent of it.

The respective relations of simulation and imitation to the real are thus seen as importantly different: whereas simulation is *as if* real, contained within a purely artificial world with arbitrary and distant connections to the real, imitation is *just like* the real and, in a sense, flows into it. *As if* simulation depends, conceptually, upon the absence of the real, whereas imitation depends upon its presence, as a model which one seeks "to be," or to make something, *just like*. Where simulation contains players within a bounded world distinct and separate from the real, imitation blurs boundaries between game and world, between imitation (mimetic activity) and a real competence, activity, or practice. Not only is an imitation *just like* the real, players using new polymodal, gesturally responsive controller technologies can, increasingly, act *just like* singers, guitar-players, pilots, athletes, composers, artists, and so forth, and in ways that invite players—through play—into worlds of authentic practice and competence.

Juul (2010) states that mimetic games move the action from abstract "screen space" to more encompassing, kinesthetic "player space," and suggests that mimetic interfaces, by "draw[ing] upon familiar conventions from outside video games" (p. 116), or "pre-existing knowledge of real-life activities" (p. 119), are convivially supportive of offscreen social interactions (p. 121). However, from the standpoint of learning theory, Juul focuses less on the actual activities being imitated, the corresponding real-world talents or practices that players might engage, negotiate, share, and learn. If these emergent controllers can be said to be mimetic, we can look beyond the game's "player space" to consider the *practices being imitated*, and the network of learning and participative opportunities that may be supported by these affordances, information systems, and wider social ecologies. As Jørgensen (2013) states, emergent controllers, information mapping technologies, and corresponding interactive feedback systems enable these games to sensitively "mimic" a "non-computerized situation in the physical world . . . highlight[ing] the mediation process instead of subduing it (p. 50) . . . [and] heightening the sense of involvement" (p. 52). Through mimetic interfaces that shift the mode of play from *as if* to *just like*, these innovations, we argue, may increasingly enable players to engage in practices and (learning) experiences, procedures and roles, that more directly transport and transform the actors "in play"—principally, by bringing those *real-world* activities, and wider socio-technical ecologies of practice, into *virtual* presence.

In this sense of intrinsically requiring presence, Adorno (1984) observes that "mimetic behavior does not imitate [copy] something but assimilates itself to that something" (p. 163). Adorno thus sees imitation and "the mimetic impulse" as "vital experience" affording sensuous and corporeal access to (real) world techniques and practices. Through imitation, a learner both adapts to and embodies cultural practices, gestures, and capacities: the learner "adopts gestures, representational forms, and patterns of action and makes of them its own expressive forms" (Gebauer & Wulf, 1995, p. 286). Beyond simply copying things, or re-producing representations, then, mimesis implies dynamically sharing in practices, processes, and situated procedures.

Mimetic engagement of this kind, we emphasize, is not only very different from button-pushing (simulation) environments, but is also very different from traditional training and/or schooling practices. As Walter Benjamin (1928/1973) argued, mimetic performance, as a vehicle of learning, describes a mode of educational engagement that stands very much in contrast to traditional modes of teaching propositional facts, segmented technical skills, or gradually sequenced curricular knowledge. In Benjamin's view, mimetic performance places learning actors within a world of practice, where learners are enabled to situationally engage authentic challenges, improvisationally "lay hold" of polymodal artifacts and dynamic challenges, and thus more directly embody and enact *real* positions of competence (Benjamin, 1928/1973; Buck-Morss, 1991; Walker, 1987). What is important for our argument is the idea that such mimetic involvements and performances do not simulate a world for learning actors, but virtually place them within a "real" world of sustained practice, haptic negotiation, and serious play.

We think it significant that while foundational theories of simulation and gameplay construe imitation as a kind of outcome or practice that *defines* a simulation game, it is not the case that such imitation simulates a distinct and separate reality (Grüne-Yanoff & Weirich, 2010; Ören, 2005; Rothgeb, 2008; Yilmaz et al., 2006).[2] *Unlike* simulation, we follow earlier theorists in arguing, imitation is more accurately seen as being modeled upon "the real" and, as such, as co-extensive with it. Imitation (mimesis) can thus be viewed as a set of relational practices that "refer to the activity of a subject which models itself according to a given prototype" (Adorno, 1984, p. 34), though not in a purely duplicative way where given prototypes are merely reproduced. Mimesis, Adorno insists, is not merely a passive or receptive process, but a sensuously active and co-creative one: mimetic actions involve—and re-form—persons and communities in the shaping of, and adapting to, what they imitate. Through mimetic activity (acting *just like*), players/learners are enabled to engage authentic challenges and adopt aptitudes, actor roles, or positions of agency that would, under conditions of simulation, belong, formally, to *another* distinct actor or specialized body (Rancière, 1989, 1991).

So it might be that in-the-doing, *through* the very act of imitation, a particular behavior is in reality accomplished, enacted or embodied, and this important conceptual distinction between imitation and simulation, we believe, impacts the possibilities of digital gameplay as a valuable learning resource. By examining the emergent affordances of imitative gameplay, we see a more direct relationship, and a more direct alignment, of such gameplay with learning to act *just like*. Through this mimetic relationship (supported by gesturally responsive game controllers), we argue that players can more effectively engage and authentically learn through pleasurable gameplay. We will endeavor, next, to make this claim more concrete by showing how recent controller technologies and interfaces make behavioral imitation much more "real" than classic controllers ever could.

Corporeal Play: New Modes of Imitation

Although by no means entirely supplanting classical (button-based) controllers, the last few years have marked significant evolution for commercial games in terms of the kinds of imitation-based controllers that can be used to interact with games.[3] Challenging simulation-based theories about gameplay and learning, new game controllers are increasingly becoming technologies—prostheses—for real-world cultural practices of knowing, designing, making, and doing. Echoing Adorno and Benjamin, Dourish (2001) remarks, looking at human-computer interfaces that support embodied interaction, that embodiment denotes not only "physical presence," but also "participative status": "by embodiment I mean a presence and participation in the world, real-time and real-space, here and now" (p. 8). This is one important way, we think, to understand the ways next-generation game controllers increasingly support corporeal interaction and afford embodied imitative activity.

Taxonomically, today's mimetic game controllers can be divided into three categories: the Wii wand and its various subsequent accouterments, from plastic sports equipment to balance boards and music-related devices (dance pads, microphones, plastic guitars, and drums); the NINTENDO DS (movement sensors, voice recognition, built-in camera); and the Microsoft KINECT and PLAYSTATION Eye Camera (that use cameras/sensors to track player movement and display the movement back to the player through an avatar, typically on a video screen). All these controllers encourage (and sometimes demand) a wide range of embodied, active play that corresponds to and imitates (instead of being simulated by) on-screen action. For example, both Wii SPORTS and KINECT SPORTS enable players to control an avatar to play an array of sports games. In order to play, the player gesturally imitates a golf swing, or a tennis swing, a boxing jab or hook, a baseball swing or bowling ball throw with the controller. Or, using the Wii balance board, versions of the TONY HAWK skateboard series have shifted from arcade-style buttons to intuitive, highly sensitive, motion-detecting balance boards (with infrared sensors that even detect subtle hand motions). Thus, the player imitates real-world action that is correlated with action within the game. While it is possible to "cheat" the action and not fully swing a golf club, for instance, for the most part the action the player imitates requires a high-degree of kinesthetic fidelity (say, when throwing a punch in boxing, leaning into a skateboard move, or putting spin on a tennis swing). The Wii marketing campaign of "Get up and play" inverts the ethos of digital gameplay as a sedentary activity, and studies have begun to show transference of competencies from video games related to health and fitness, including balance and physical skills (see, for example, Boschman, 2010; Papastergiou, 2009; Sell et al., 2007; Vernadakis et al., 2012).

Holsti, Takala, Martikainen, Kajastila, and Hämäläinen (2013) have integrated visual mapping and skeletal-tracking technologies with the Microsoft KINECT platform to create a dynamic trampoline-based environment to support exercise and movement training in game-based environments. Touching directly on the issue of imitation, Kajastila and Hämäläinen (2014) have developed an augmented climbing wall that tracks climber movement and projects graphics (including climbing routes, hold alternatives, and obstacles like animated chain saws) as part of climbing/learning regimen, one "which makes training fun by adding relevant goals and encouraging social collaboration" (p. 1).

Dance pads have enticed players into more physically active forms of engagement, and they are among many music-related controllers that have reshaped digital gameplay (Sell et al., 2007; Warburton et al., 2007). GUITAR HERO and their several successors use plastic guitars as controllers, with the player imitating playing a guitar by pressing colored keys in time to a music track. The difficulty is increased by the number of notes/buttons required (3 is the easiest, 5 the hardest), speed of play, and number of notes played together (to create a chord). Very literally, then, the player's imitative action corresponds, mimetically, affectively and physically, to "playing" the notes displayed on the screen. In ROCK BAND, too, players engage and imitate musical play through singing, playing guitar, and by using traditional wooden drumsticks on a set of plastic drum-pads that work in similar ways to the guitar, in that a player hits the correct colored drum as directed by the music. In addition, just like a real band, ROCK BAND is designed to be played collaboratively, with several members performing simultaneously (vocals, drums, lead guitar, and bass), and with bonus points being earned for more tightly co-ordinated group performance (Fahey, 2009). Here, it matters not only how accurately individuals realize the game script, but how effectively they attend to one another *for real* (and not just to the game screen) in order to play well together (de Castell, Boschman, & Jenson, 2009).

What is yet to be explored in these imitative practice-based games is whether, how and to what extent skills acquired in playing them can be transferred to their real-world equivalent activities (the classic educational problem, noted at the outset, of transfer-of-training). Here, Peppler, Downton, Lindsay, and Hay (2011) signal a transfer-of-training in ROCK BAND players' abilities to internalize musical concepts and compositional forms (in effect, building understanding of how "music works"). Could it further be the case that someone highly skilled at a game-like GUITAR HERO or ROCK BAND will actually improve their music skills in the real world, and which skills would those be: those related to rhythm and timing, perhaps, or the ability to read, or sight-read, a score? Is it possible to use games like SINGSTAR or AMERICAN IDOL as means of training one's voice? (How) does playing Wii TENNIS improve someone's tennis game?

Mimetic interfaces, in order to invite (novice) players into the game, must to some extent simplify (at least initially) the practices or challenges being engaged. The fidelity of a mimetic controller to the real object of use, then, must too be mediated by matters of accessibility, or in terms of optimal playability, so that players might experience competence (Juul, 2010) and determine, for themselves, the degree of difficulty and perhaps, as these controllers continue to develop, the degree of fidelity.

Yet whether a discrete skill or precise technical acumen is faithfully transferable or not may, arguably, be trumped by another learning variable, which is neither propositional nor skill-based: that of *affect*. Engaging a talent through imitative play, or music-making and dance through corporeal game-based controllers, sets into play an affective relationship to musical forms, and to sensuously experiencing and (imitatively) composing music, pictures, and so on, or to mimetically adapting to complex aptitudes, including adopting authentic, creational "maker roles" through the process. Although a clear-cut technical objective may not yet be directly transferable with new controllers (e.g., playing a traditional musical score "correctly," or the ability to improvise a guitar solo), the expressive, corporeal, and pleasurable relationship to making and doing music may indeed be transferable (Peppler et al., 2011). It is in the *affective*—and socially mediated—dimension of imitating a talent or creative identity where mimetic activity may function as a performative link—as well as an invitation—to "really" performing, that is, to embodying the role of the social actor (or specialist) being imitated. As Squire (2008) notes, video games teach "players more than just facts, but ways of seeing and understanding problems and opportunities to 'become' different kinds of people" (p. 7). In this sense, imitative play thus permits players to, as Rancière (1991) puts it, "experiment with the gap between accreditation and act" (p. 15): that is, mimetic play more directly enables learners to enact capacities by performatively engaging the same challenges, or in some way adopting the same talents, as the expert actor who is being emulated.

This stands in marked contrast to the ideal of "good simulation," which demands representational fidelity to salient aspects of a performance or training goal. For Klabbers (2009), the challenge of simulation is to "bridge the gap between knowledge and action" (the transfer-of-training problem in its classic form). However, the analysis of complex tasks is itself an inordinately complex matter: *which* aspects have greatest salience? Or, to put the question slightly differently, of *what* task features, aspects, elements, and components should fidelity be demanded? Here, the bias in simulations is toward accurate task analysis and faithful representation of salient aspects of the task analyzed, whereas the bias in imitation is toward the modeling of exemplary performance, and its end is toward experiential verisimilitude, the embodiment of competence, or the optimally mediated pathway toward embodied competence. The locus of the distinctive "truth claims" of simulation and imitation can thus be seen to be polar opposites, with simulation's investment in veridicality being toward knowledge and information, and imitation's orientation to verisimilitude inclined, rather, toward presence, haptic experience, situated action, and embodied performativity.

This is because simulations are created to represent *what is true* about a task or condition, to represent the real world (or some aspect of it) as faithfully as possible, whereas imitative practices are enacted to experience and practice *what it is like* to engage in a given task or activity. The former seeks to use "knowing that" within a represented reality (Franklin, 1990) as a bridge to "knowing how" (Klabbers' "gap between knowledge and action"). The latter seeks to build know-how in the "real" world through imitative practice in a "virtual" one. Through mimetic play, and through controllers that afford embodied inter-action, the so-called bridge or "doorway" to formal tasks or authentic practices might better be conceived as a permeable and uncertain membrane. New media thus require new metaphors and performative tropes that can comprehend and specify the complexity of player actions and embodied interactions.

In the ROCK BAND study cited above, Peppler et al. (2011) state that "the ways music is represented in *ROCK BAND* provide players with a 'doorway' into more formal music practices by heightening players' interest and abilities in music" (p. 41). The interactions of game players (with the game technology, and with other players through both the game console and real-life attention, interaction, and coordination) have, in many respects, crossed over from representation to corporeal performance, that is, to mimetic activity. The "doorway" of transfer between gameplay and musical competence is constructed less through "representation" (p. 43) than through embodied *just-like* performances that challenge clear-cut distinctions between the "opposite sides" of this door. The authors state that "musical concepts" are "embodied in rhythmic games' notation systems, including models of metric hierarchy, subdivision, and note patterns" (p. 41). If musical concepts are thus embodied in the game's notation systems, we would stress that they exceed such representational similitude to become, with new corporeal controllers, *re-embodied* through player performances and gestural/kinesthetic interactions. As Juul (2010) points out,

> playing sheet music on the piano at first feels exactly like playing *GUITAR HERO*: you feel the notation telling you what to do . . . Subjectively, playing *GUITAR HERO* isn't any less real than playing a piano is when you first begin to learn to play, and this is probably why you do feel as if you are playing music, playing *GUITAR HERO*. (p. 115)

Or as Wittgenstein (1953) much earlier characterized this performative, momentum-building breakthrough to competence, "Now I know how to go on" (No. 154).

Lest this simulation/imitation distinction be stymied by the existence of technologies (and games) such as the highly effective and widely used flight simulator, we need now to address the phenomenon of convergence, where a technology utilizes *both* imitative and simulative means. These convergent cases of, for instance, a flight or driving simulator (or even more powerfully, a training simulation embedded within its real-world context) are illustrated by Salas, Rosen, Held, and Weissmuller (2009), who cite as examples of best practice an embedded training system within military aircraft that supports realistic in-flight training and pre-mission rehearsal while on route to the actual mission (Salas et al., 2009, citing Cooper, Viney, & McDermott, 2003). That some, arguably few, instances admit of such a convergence does not, however, obviate the need for a clear distinction to be made and understood between simulation and imitation. We see a world of difference between fully imitation-based and fully simulation-based play; however, in some cases, they co-occur and co-operate. The reason a flight simulator can be as *imitative* of flying a plane as it is a simulation of plane-flying is that the interface a pilot really uses nowadays to perform the activity of plane-flying is, morphologically, very like the interface a game player uses to play (or use) a flight simulator. This was of course not always the case: In the early days of aeronautic technology, the control technologies and piloting activities of flying a plane were as different from playing a digital game as button-pressing is from jumping. That contingent fact is, however, not a reason to abandon a fundamental conceptual distinction. In addition, interface designs moving in either direction from that point of convergence will necessarily sacrifice experiential fidelity for informational accuracy in the case of simulation games, and sacrifice informational accuracy for experiential fidelity, in the case of imitative games.

We argue that the embodiment of play in imitation-driven digital games gives reason to suppose that both the work and the learning involved in play may afford, and increasingly afford as these technologies further evolve, effectual transfer of the knowledge and skills thereby imitated, because the player uses the real as the model against which to learn to be *just like*.

Although the button-mashing of simulation-based play may impact players' thumb and finger muscles, Wii players imitating boxers really do sweat, ROCK BAND drummers develop stronger arm muscles and rhythmic attentiveness, singers learn to hold a note longer and with more sustained pitch, and GUITAR HERO guitarists read and follow a musical score and learn to make fast and accurate chord changes. What is important here is less the specific changes co-constructed by player and game, and more the larger possibility that, with technologies supporting players' embodied competence (rather than players' ability to simulate such competence), the way digital games can work for education might well have shifted. We believe this entails a move from carefully calculated abstract information embedded in a representation of the real, to a more directly embodied imitation of it.[4]

Discussion: What Matters

From the perspective of actor-network theory, what matters enormously is the specific system and context of activity, what is required by, and can be afforded to, agents through tools and technologies, strains and supports. If we are looking to increase students' abilities to generate correct propositions about states of affairs in relation to that which they themselves have neither any agency nor any embodied competence, but which they can read off from a complex digitally effected simulation, then much "traditional learning" can still be conveyed through simulation-based digital games (cf. Asakawa & Gilbert, 2003; Bachen, Hernández-Ramos, & Raphael, 2012; Sitzmann, 2011). Still, it is critical to recognize that the gameplay skills players develop through simulation games are not like the skilled actions that are engaged and performed in and through imitative play. Player actions within simulations are arbitrary vis-à-vis the real event, and so they must be. This is a point of *conceptual necessity*, as simulations necessarily stand in for the real, and in that sense simulations are, paradigmatically, detached from situationally embodied practices and authentically performative challenges. Jumping, in games where that action is accomplished by pressing a button, lacks any direct real-world correlation, so its simulated representation has nothing to do with whether or not someone can or actually does jump. Imitative play, by significant contrast, engages players with the forms and functions of the real, which their efforts seek to increasingly become *just like*. This distinction between *as if* and *just like* is, we contend, central to whether and how a digital game can bridge the transfer-of-training gap between learning and application.

Following Adorno and a long list of educational theorists, from Plato and Rousseau (1762/1979) through Dewey (1934) and Piaget (1962) to Vygotsky (1978) and Gallop (1995), we see mimetic activity as a form of vital experience, and that sensuous, corporeal gameplay can become a means of both accessing and enacting authentic aptitudes and creative capacities. Following actor-network theory, we suggest that mimetic interfaces are increasingly mediating constituents of socio-technical ecologies and communities of practice. How then might these mimetic interfaces, as controllers for imitation in video games, shift from being controllers of gameplay to becoming actual interfaces for authentic cultural production? For example, where and how might mimetic activity in video games connect to composing and performing authentic musical artifacts, or to choreographing and sharing a dance, climbing route, or athletic routine? In this context, video game players assume both individual and collaborative roles as composers or designers, where what they design, make, and perform might be seen as artworks, or as game challenges, or as *both*, for other player-composers.[5]

In any case, whether for hardcore players or for initiates new to digital games, if educational activities are to be transformative for learners, they must instantiate players' own goals, rather than serve as a causally effective, instrumental means to an independently defined end. This concordance becomes possible when the learning goal and the learning activity—the practical process of meaningfully doing, making, or playing—are continuous with and complementary to one another. In educational terms, this intrinsic relationship is what defines an educational experience, as opposed to a mere training exercise. To put it a bit differently, following a philosopher of education, Richard S. Peters (1967), if the process is not itself educational, the product cannot be an education.

Taking a cue from Peters, here, we see enormous promise for the advancement of educational processes and outcomes in the continued development of imitation-driven digitally supported games and play environments. If we continue to look myopically for a testable, demonstrable increase in students' mastery of traditional school facts and skills, and if we restrict our conceptions of video games to violent first-person shooters, then we will find more is lost than gained, educationally, from video game play. However, if we identify and study the many and varied networks of affordances that digital gameplay offers, the shift of focus from simulation to imitation may offer genuinely productive avenues for research and educational practice, avenues that take more fully into account the dramatic and ongoing transformations in learning and learners, knowledge and knowing, agency and modes of acting, in an increasingly networked society.

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Notes

1. In 2011, GUITAR HERO III: LEGENDS OF ROCK was at the top of the list of total sale revenues for the life of the game, beating out the very popular CALL OF DUTY franchise (Orland, 2011).
2. As a representative example of the conflation issue we are examining, simulation is used as a general conceptual term that subsumes both the *as if*, simulative "reproduction of

the essential features [of a task] for the purpose of training" *and* the embodied, imitative/mimetic "enactment of an experience" in practice (Rothgeb, 2008, p. 489). We contend that imitation-based controllers require us to make distinctions between simulation and imitation, and to explore the novel modes of learning/agentive experience that imitation-based controllers may afford game players.

3. That is not to say that the more "classical" controller is not still the "default" way of playing with games as the fourth generation of game consoles announced in 2013 attests: Neither Microsoft nor Playstation have considerably altered their main game controllers.
4. Research that considers musical skills learned from video games thus far focuses on the potential of music games to teach the elements of music (Cassidy & Paisley, 2013; Gower & McDowall, 2012; Gumulak & Webber, 2011), and provide a engagement with music outside the classroom (S. Young, 2012). A few small research studies also demonstrate that rhythm games such as GUITAR HERO do not improve perception of meter (Gaydos, 2010), but instead that participants improve at reading in-game notation (Richardson & Kim, 2011).
5. For example, intuitive and feedback-rich arts-based digital media invite players to enact art-making talents in ways that emulate the experimental, improvisational, and imitative attitudes of game-based play. One such novel technology is the TENORI-ON, a device that has players using touch-screen interfaces to compose original musical artifacts, enhanced by game-like online platforms that enable multiplayer collaboration among actors/artists in improvisational real-time. Game-integrative compositional media like the TENORI-ON thus enable (multiple) players to engage aesthetic challenges and enact incidental, but significant, learning outcomes: for example, practical knowledge of musical modes, key signatures, scales, chord/interval relations, rhythm and tempo, as well as "domain-specific languages" (Downton, Peppler, & Bamberger, 2011). In terms of interface, with the TENORI-ON the original hardware version of the product and its (much cheaper) iPad versions share the same basic interfaces and controller media.

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