17 Digital Games as Language-Learning Environments

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Learning, Language, and Games

Human development can be catalyzed by many factors, for example through adaptation to novel social, symbolic, or material conditions, opportunities for individual and collaborative interaction and problem solving, and consequential decision making. Learning also develops as a function of large volumes of effortful engagement, which makes relevant the importance of motivation, positive affect, cultivation and maintenance of social relationships of significance, and, of course, the pleasure in pursuing forms of activity that are complex and difficult to master. Digital gaming, and more broadly the role of ludic engagement as a form of developmentally productive activity, brings together many of these factors.

Extending back to the earliest days of computing and the advent of public access to the internet, and over the past decade in particular, there has been a mercurial rise in interest in play environments that take the form of digital games. Catalyzed by advances in hardware and networking technologies, the maturation of digital games has been accompanied by exponential growth in the types and genres of games available and the number, diversity, and geographical distribution of players. The global video game industry is growing at an unprecedented rate, as are profits. An April 2018 report (Newzoo, 2018) forecast that 2.3 billion gamers worldwide would spend US$137.9 billion in 2018, an increase of 13.3% over 2017. The October 2018 release of *Red Dead Redemption 2* earned more in its opening weekend (US$725 million) than the biggest opening weekend for any film (US$640 for *Avengers: Infinity Wars*) (Crecente, 2018). In 2016, 20 countries had game industry revenues over US$500 million (Statista, 2018), and according to the Wikipedia entry on game developers, video games are developed in over 40 countries (Reinhardt, 2019). It thus stands to reason that video games are produced and translated in the common languages of the top global markets. Moreover, because global interest in new game titles does not dictate distribution and availability of those titles in multiple languages, it also stands to reason that millions of people

around the globe play games not in their first language but in an additional one, often English or another language of wider communication.

Because of its global spread across many language and culture populations and a plurality of devices, from mobile phones to personal computers and gaming consoles, gaming has spawned complex and heterogeneous online communities and linguistic and cultural practices (Thorne & Black, 2007). Games are, de facto, learning environments that are intentionally designed to guide players to higher levels of skill and challenge over time. Increasingly, the use of gaming features and mechanics has been leveraged for educational purposes in what has been described as the *serious games* movement, and games designed for second and foreign language (L2) learning continue to become available in greater numbers. In part because some genres of recreational digital games are language intensive, language researchers and educators have also explored the use of commercial off-the-shelf digital games (primarily multiplayer games) as sites for L2 use and learning. In contemporary scholarship within fields such as education, applied linguistics, and world languages, online gaming has emerged as a central focus for technology-related research and pedagogical innovation.

The following review of existing L2 gaming research, pedagogical innovation, and commentary on design is organized and presented through a lens of eight game-based L2 learning affordances: (1) contextualization and linguistic environment, (2) time and iterative play, (3) shelter for practice, (4) goal orientation and purpose, (5) languaging and sense-saturated coordination, (6) identity performance, (7) independence, and (8) autonomy. Following a general introduction and descriptions and examples of L2 cases of digital gaming, game-based L2 learning is presented according to research addressing the aforementioned affordances, which subsequently informs an agenda for future research, pedagogy, and design. Limitations, challenges, and opportunities conclude the chapter.

What Is Game-Based L2 Learning?

Online games represent a pedagogical shift from models of learning based on information presentation and toward theories of human development that emphasize engaged problem solving, collaboration, social interaction, and, in some cases, competition. Recent research has argued that some forms of gaming, particularly multiplayer genres of online gaming, present developmentally fecund environments for the learning of specialized literacies, scientific reasoning, contextualized engagement with content knowledge, high-level problem solving (Bogost, 2007; Gee, 2003, 2007; Grimes & Feenberg, 2009; Nardi & Kallinikos, 2010; Plass, Homer, & Kinzer, 2015; Squire, 2006, 2008; Steinkuehler & Duncan, 2008), and even provide dynamic opportunities for the development of leadership abilities (Thomas & Brown, 2009). The general research on gaming for learning (and particularly in language-rich and communication-intensive

environments) supports continued exploration of gaming for language learning on three fronts: (1) to investigate naturalistic language use and language learning in recreationally oriented gaming environments, (2) to assess language learning processes, efficiencies, and outcomes in gaming environments designed for L2 learning, and (3) to draw from all available evidence in order to pedagogically amplify language learning from recreational gaming experience (for example, by coupling it with traditional instructional methods; see Wouters et al., 2013) and inform the development or iterative improvement of existing L2 game environments. Following the terminology used in this volume, we use the term "game-based" learning throughout the chapter. However, we wish to acknowledge Reinhardt and Sykes's (2012) distinction between using "game-based" to refer to the use of L2 learning-purposed games, "game-enhanced" for the use of vernacular (i.e., noneducational, generally recreational) commercially produced off-the-shelf games, and "game-informed" for the application of game mechanics to educational processes and contexts (including what is commonly referred to as gamification; for a discussion in L2 contexts, see Reinhardt & Thorne, 2016).

L2 classroom instructors have long used games and simulations as pedagogical techniques. Since they first appeared more than 40 years ago, digital games have been used for both informal and formal L2 learning (Hubbard, 1991; Jones, 1982; for a review, see Peterson, 2010). While the more recent rise in popularity of commercial digital games was initially met with considerable skepticism, both within language teaching and more broadly in education and among the public, many have come to recognize games' potential as motivating, authentic, cognitively and linguistically complex, and effective learning environments (Gee, 2003, 2007; Squire, 2005; Thorne, Black, & Sykes, 2009). In their review article on trends in serious gaming for education, Young et al. (2012) state that games designed to teach languages "may be the most effective use of educational computer gaming to date" (Young et al., 2012, p. 74). Evidence of interest in digital game-based and game-enhanced language learning is now well represented in book-length treatments (Mawer & Stanley, 2011; Reinders, 2012; Reinhardt, 2019; Sykes & Reinhardt, 2012), special issues of journals (Cornillie, Thorne, & Desmet, 2012; Reinhardt & Sykes, 2014), and special-interest groups at international computer-assisted language learning conferences (e.g., EuroCALL and the Computer-Assisted Language Instruction Consortium, CALICO).

In addition to game-based L2 environments and apps, it is relevant to reiterate that gamers around the globe often do not have access to games in their first language and therefore play them in an L2, learning the language informally and in a just-in-time manner in order to play (Chik, 2012; Sundqvist & Sylvén, 2012; Thorne, 2008a, 2010; Thorne & Fischer, 2012). Vernacular games are authentic and lived-in cultural artifacts, and, in this sense, online gaming is a socioliteracy practice involving interaction and engagement, which can lead to meaningful, contextualized, and goal-directed L2 use and learning. (Certain genres of gaming communication may be limited in their

transferability to other contexts, however. See Ensslin, 2012; Thorne, Fischer, & Lu, 2012.) Designs associated with adventure, narrative-rich role-play, and collaborative multiplayer games are recognized as affording the dynamics of L2 learning; accordingly, the most researched genre in the field is massively multiplayer online games (MMOs) (Peterson, 2016). At the same time, as L2 educators and material designers have recognized the motivating and developmentally productive qualities of vernacular games, they have also sought to create game-based learning environments and applications specifically for L2 learning. Some have been created by designer-instructors for local and experimental uses (Cornillie et al., 2012), and a few have been developed by educational publishers and made commercially available—for example, McGraw-Hill's *Practice Spanish: Study Abroad*—although they have yet to be thoroughly evaluated.

Reflecting the diversity of theory in the field of second-language acquisition (SLA), researchers and L2 pedagogical designers have used structural-behaviorist, psycholinguistic-cognitive, and sociocultural frameworks, along with commensurate pedagogical methods (Filsecker & Bündgens-Kosten, 2012; Peterson, 2010; Reinhardt, 2019; Thorne, 2012). Research has recognized parallels among principles of game design and gameplay on the one hand and SLA, L2 pedagogy, and language use and learning on the other—for example, in quality of the linguistic environment, goal orientation, availability of linguistically mediated interaction, feedback, and contextualization through narrative framing and event-driven scenarios (Purushotma, Thorne, & Wheatley, 2009; Sykes & Reinhardt, 2012). Related evidence-based intervention projects are exploring the design of game-based L2 learning informed by processes and principles of language development (Cornillie, 2017). More recently, researchers have employed the ecological concept of affordance (Gibson, 1979), or "possibilities for action that yield opportunities for engagement and participation, that can stimulate intersubjectivity, joint attention, and various kinds of linguistic commentary" (van Lier, 2004, p. 81), for understanding the L2 learning potentials of particular game designs and environments. From an ecological perspective, various combinations of designed game mechanics, when enacted in certain gameplay contexts, can be understood to afford dynamics that correlate with L2 use and learning (Reinhardt, 2019).

Examples of Game-Based L2 Learning

Game-based and game-enhanced L2 learning can occur in a variety of settings (e.g., informally in the wild, in experimental conditions, and in more formal classroom environments), using both vernacular and educationally designed games. In this section, we introduce various studies that describe gameplay and its relation to L2 learning. Synoptically described, available research includes accounts of formal L2 classroom interventions using recreational games (Miller & Hegelheimer, 2006; Reinhardt, Warner, & Lange, 2014), descriptive and quasiexperimental studies of educational and

recreational gameplay (Scholz & Schulze, 2017; Zheng, Young, Wagner, & Brewer, 2009), surveys of gamer orientations to plurilingual communication, language use, and play style (Thorne & Fischer, 2012), the degree of "willingness to communicate" in online gaming environments (Reinders & Wattana, 2011, 2014), descriptions of the design and implementation of mobile game-based L2 learning applications (Holden & Sykes, 2011; Thorne, 2013), analysis of the linguistic complexity of online game worlds as an enabling condition for L2 learning (Thorne et al., 2012), and accounts of design-based experiments focused on particular game mechanics associated with known L2 learning affordances (Cornillie et al., 2012).

An early example of the use of a single-player recreational game for language learning involves *The Sims* (and its many iterations). A game that simulates the activities and responsibilities of everyday life, *The Sims* is produced in a number of languages. In an informal assessment of *The Sims* as a foreign language learning tool, Purushotma (2005) found that the vocabulary and tasks comprising the game were highly aligned with the practical everyday content of conventional foreign language curricula: clothing, food, household items, furniture and functionally specific rooms in a house, occupations, transportation, neighborhood environments, family relations, and the like. Purushotma suggests that the difference between instructed foreign language learning and a game like *The Sims* is that exposure to the target language in the latter is always linked to carrying out tasks and social actions, which concomitantly embeds vocabulary and constructions in rich associative contexts. Formal classroom contexts can support form-meaning-function association and learning in games like *The Sims* through the use of materials and instructor mediation that focuses learners' attention on particular level-appropriate language and content. For example, Ranalli (Ranalli, 2008; see also Miller & Hegelheimer, 2006) created supplemental materials for ESL learners playing *The Sims* that focused on basic vocabulary in the game. This study found statistically significant improvement of vocabulary scores after a lesson structure of briefing, gameplay with materials, and debriefing, reflecting a traditional approach to simulation-based L2 pedagogy (Crookall & Oxford, 1990) adapted to current digital games (Meskill, 1990).

The research literature shows numerous examples of informal game-enhanced L2 learning in recreational multiplayer gaming environments. One of the earliest empirical cases examining multilingual communication occurring in *World of Warcraft* described an interaction between a speaker of English living in the United States and a speaker of Russian living in Ukraine (Thorne, 2008b). The two were playing near one another when the Ukrainian communicated the following text message: "ti russkij slychajno?" (are you Russian by any chance?). The American replied with a question mark and then asked, "What language was that?" This initiated 140 turns of dialogue that began with information exchange regarding spatial location and mutual interests in gaming and popular culture. The primary language used was English, but three languages (including one instance of a Latin aphorism) were used in total. The transcript illustrated a

number of positive assets for language learning, such as natural and unscripted inter-action, reciprocal alterations in expert status, explicit self and other correction at the level of linguistic form, extensive repair sequences when communication broke down, development of a positive affective bond (adding one another as in-game friends), and exhibited motivation by both parties for learning the other's language. Exposure to and use of multiple languages within *World of Warcraft* (and other online multiplayer games, such as *Dota 2* and *Fortnite Battle Royale*) can be frequent, depending on realm and play partners, and many anecdotal accounts of language learning through mul-tiplayer gaming have been reported in online player forums (see Thorne, 2010, for examples). Related research on young Swedish students found that L2 English learning was strongly correlated with frequency, volume, and types of informal online gaming, particularly in the area of L2 English vocabulary (Sundqvist & Sylvén, 2012, 2014).

Research shows that game-enhanced L2 learning also occurs under more formal or quasiexperimental conditions. For example, Dixon and Christison (2018) report on the interactions of three L1 Mandarin players they had play *Guild Wars 2* in English. In their analysis of the in-game text chat, the researchers found evidence of com-prehension checks, form-focused feedback, and negotiation for meaning—constructs correlated to L2 learning in psycholinguistic accounts of SLA. In another example, Rama, Black, van Es, and Warschauer (2012) explored how L2 proficiency and gam-ing literacies interacted in multiplayer *World of Warcraft* gameplay. They found that Spanish learners with high gaming literacy were able to leverage their gaming skill in order to maximize affordances for communication with Spanish-speaking players, while learners with higher L2 Spanish proficiency but low gaming experience found it much harder to learn how to play an unfamiliar game and to interact meaningfully with other gamers in their L2. Informal game-enhanced L2 learning can even occur in "couch"-based multiplayer situations. For example, Piirainen-Marsh and Tainio (Piirainen-Marsh and Tainio, 2009; see also Piirainen-Marsh and Tainio, 2014) show, through ethnomethodological conversation analysis of the interactions between two copresent adolescent L1 Finnish players playing an English-language version of *Final Fantasy X*, that playing a game in an L2 affords opportunities for what they call "other repetition," or mimicry and language play, with the dialogue produced by nonplayer characters in the game, which builds language awareness and ultimately contributes to proficiency.

Finally, as game development becomes more available to amateur designers, more L2 teaching professionals are creating, testing, and researching games for particular learner needs and contexts. For example, in their hybrid mobile game, Berns, Isla-Monte, Palomo-Duarte, and Dodero (2016) layered structure-focused learning activities with more collaborative game elements, first teaching the players the vocabulary they would need to play the game through traditional minigame (grammar and vocabulary) type activities and then having them come together and role-play a pervasive murder

mystery game. Results based on surveys and player data showed increased learner motivation and positive learning outcomes.

Game-Based L2 Learning

Second-language acquisition is a contentious field comprised of diverse and competing frameworks, but virtually all approaches acknowledge the importance of the quality of the linguistic environment and opportunities for meaningful and contextualized communicative engagement as primary contributors to developmental outcomes. To begin with a few preliminary observations that describe the theoretical perspective of learning taken by the authors, humans can be seen as open systems, with the implication that development arises as a function of interaction within historically formed, and dynamically changing, social, symbolic, and material ecologies (de Bot, Lowie, Thorne, & Verspoor, 2013; van Lier, 2004). When viewed this way, learning of whatever kind cannot be clearly separated from life experience. Rather, life activity and development form an "ensemble" process that is enacted along a brain-body-world continuum (Spivey, 2007). This open system principle entails a number of ideas, one of which is that human action is mediated by symbolic tools and material artifacts, physical and social surroundings and dynamics, and sedimented histories of social practice (Vygotsky, 1978; for its application in L2 research, see Lantolf & Thorne, 2006). This perspective is particularly relevant to assessing technology-mediated communicative and cognitive activity since the meditational means at hand—a computationally enabled gaming environment, for example—potentially transform the morphology of human action in ways that affect developmental processes and outcomes (Thorne, 2016).

An ecological perspective on L2 learning (van Lier, 2004) recognizes language and learning as involving situated, contextualized processes that are both cognitive and social. It offers the useful concept of affordance (Gibson, 1979), an ecologically available action potential for language use and learning that can be aligned with theories of game design relating designed mechanics and player dynamics (Hunicke, LeBlanc, & Zubec, 2004). Similar to an L2 learning affordance, a game mechanic or design feature can be understood as an actionable dynamic or behavior. The potentiality and contingent nature of the concept fit with the unique quality of games as ergodic and emergent; that is, that they must be played to be fully realized, and each time they are played, outcomes may differ. While research on game-based L2 learning can be categorized according to its alignment with particular SLA theoretical frameworks, the design-informed lens we use here focuses on a number of game-related L2 learning affordances: (1) contextualization and linguistic environment, (2) time and iterative play, (3) shelter for practice, (4) goal orientation and purpose, (5) languaging and sense-saturated coordination, (6) identity performance, (7) independence and spatial mobility, and (8) autonomy.

Contextualization and Linguistic Environment

A major affordance for L2 learning in many games is that coherent narratives are used to contextualize game mechanics, allowing the learner-player to associate form, meaning, and function through interaction with multimodal representations. As with aforementioned studies of *The Sims*, this affordance is manifest in simulation games where players can manipulate or interact in the L2 with everyday, familiar objects, spaces, and actions. When players are primed with certain vocabulary before playing, through the use of supplemental materials, retention rates are higher (Ranalli, 2008) and learners retain knowledge of primed vocabulary longer than for incidental and nonprimed vocabulary (Shintaku, 2016). Franciosi (2017) found that an experimental group exposed to vocabulary in a simulation game in addition to regular instruction retained vocabulary knowledge statistically significantly longer as measured by uses of the language in a debriefing writing task.

In many multiplayer game genres, players are exposed to copious texts during game-play, for example quest texts, in-game text communication, and paratexts (or attendant discourses) such as game-external online strategy and lore websites that are often contrapuntally used during play. In contemporary research on language acquisition, usage-based investigations (Ellis, 2002; Tomasello, 2003) have underscored the importance of the quality of the social and linguistic environment as it relates to developmental trajectories. Characteristics such as input frequencies, linguistic complexity, and language-mediated opportunities for joint attention and meaningful engagement are understood as foundational to language learning. A fundamental question then is, what is the linguistic quality of recreational game-associated texts? Selecting *World of Warcraft*, the most popular MMO at the time, Thorne, Fischer, and Lu (2012) used corpus and computational linguistic methods to assess the linguistic complexity of game-generated "quest" texts that guide player actions and of the game-external texts that were designated by players as central to gameplay (i.e., particular strategy websites). All texts examined were in English, with the presumption that this information would be relevant for L2 learners of English and potentially would also be generalizable to analogous texts in other languages. Linguistic complexity can be broadly defined as the range and sophistication of language forms and structures. Thorne et al. (2012) assessed the linguistic complexity of multiple corpora of texts related to *World of War-craft* using four measurement types: (1) readability, (2) lexical sophistication, (3) lexical diversity, and (4) syntactic complexity. A synopsis of the findings is that representative samples of quest texts and external websites, analyzed at the level of individual sentences, reveal mean average complexity measures that approximate a secondary school reading level suitable for students aged 13–17 years. Closer analysis, however, revealed a polarized distribution of sentences that clustered in two extremes—those that are short and syntactically simple and those that are long and syntactically highly complex. The graphical representation of the distribution of sentences for each corpus

type showed a right-skewed (or complexity-weighted) "U" pattern. This indicates that there is considerable variability in sentence complexity levels within the texts, with the most complex levels of sentences occurring with the greatest frequency. This secondary distributional analysis illustrated that, in quotidian gameplay, gamers encounter a high proportion of lexically and syntactically complex sentences. To summarize, the linguistic input from written texts, both internal and external to the game, subserves language learning.

In addition to the empirically assessed high linguistic complexity of game-related texts discussed earlier, research by Steinkuehler and Duncan (2008) illustrates that *World of Warcraft* discussion forums foster "scientific habits of mind." Analyses of nearly 2,000 forum posts related to *World of Warcraft* revealed that 86% of the entries displayed "social knowledge construction" rather than "social banter," 65% treated knowledge "as an open-ended process of evaluation and argument," more than half the posts included evidence of systems-based reasoning, and 10% showed scientifically precise model-based reasoning (Steinkuehler & Duncan, 2008, p. 539).

Time and Iterative Play

A second affordance is that game designs can manipulate normal time progression and may allow players to do so as well, often for the purpose of completing an in-game task. Repeatability is an affordance for any sort of practice-based or mastery learning, but L2 processing in particular can be afforded by slowing, repeating, or rephrasing input or by enhancing it with captions or other forms of annotation. In addition, fluency can be developed by prohibiting learner control of pacing and requiring language production or performance under time pressure. Because of this, some have argued that genres such as simulations, adventure, interactive fiction, and turn-based strategy games are optimal for L2 learning, especially if they allow self-pacing and incorporate features such as captions and repeatability and do not penalize players for taking their time (Reinhardt & Thorne, 2016; Sykes & Reinhardt, 2012). On the other hand, multiplayer collaboration under time pressure, as in newer cooperative and multiplayer survival games, may afford learning because they push or force spontaneous language production (Reinhardt, 2019).

Empirical research on the affordances of time have focused on the limits of working memory, especially in action and multiplayer games. DeHaan, Reed, and Kuwada (2010), for example, had pairs of L1 Japanese English learners—one playing, one watching—play a dance game and found that those actively playing the game retained fewer new vocabulary items than those watching. They speculate that the working-memory capacity of the players was exceeded as they were forced to learn the rules of the new game while playing it, while the observers could focus on the vocabulary of the game. In a related study using *WarioWare* minigames, DeHaan and Kono (2010) likewise found that vicarious observers of gameplay learned twice as much vocabulary

as those playing, suggesting that the cognitive load of playing while simultaneously learning an L2 may be overly taxing until routine skills associated with gameplay become familiar and automatized. The implication is to recognize that in multiplayer games and games where pacing cannot be controlled, L2 learners may be cognitively taxed if they are unfamiliar with the game. Pedagogically, these studies argue for continued experimentation with collaborative play on a single device or screen, and even consideration of Twitch streaming and related eSports events as potential areas for research.

Games as a Shelter for Practice

A third affordance for L2 learning is the self-contained quality of games as a shelter for practice and space for anonymized participation. In MMOs and game-related affinity spaces, L2 learner-players can encounter like-minded communities with more interest in gaming than linguistic fluency. In these environments, players may find speakers of a variety of languages as well as opportunities for transcultural and translingual interactions (Thorne, 2008b) but can mask their true identities if desired. Because the stakes for failure in a game task may be low and anonymized, learner-players may be more willing to take risks. For other learners, however, the prospect of interaction with native and expert speakers can raise anxiety and negatively impact willingness to communicate and risk taking, which are recognized as pivotal to successful L2 learning (MacIntyre, Dörnyei, Clément, & Noels, 1998). For those students, sheltered game contexts may be more appropriate. Reinders and Wattana (2014), for example, found that Thai learners of English produced more language and reported more willingness to communicate when completing tasks in a modded version of an MMO run on a LAN in comparison to the open public version of the game.

Goal Orientation, Purpose, and Feedback

A fourth affordance is related to the parallels between evidence-informed practices in L2 pedagogy regarding learning task design and the goal-directed nature of, and feedback mechanisms designed into, game tasks (Purushotma et al., 2009). In short, L2 learning is more likely when the language is used for purposes meaningful to the learner. A well-designed L2 learning task requires using the L2 as the means to complete it rather than having it serve as the direct target of instruction. This mirrors how learning in well-designed games is an epiphenomenon of play (Arnseth, 2006) rather than the point of play. A well-designed game makes clear or discernible to players the object and purpose of any game task, and its outcome should be integrated and relevant to ongoing gameplay (Salen & Zimmerman, 2004). As Gee (2003, 2007) has suggested, digital games are engineered to enhance human experience in the realms of "control, agency, and meaningfulness" (Gee, 2007, p.10), a condition that helps explain why players invest such significant amounts of time in gameplay. For most individuals, it

can require hundreds of hours of playtime to access advanced levels of game content, and while there can be considerable repetition in the types of challenges presented, depending on the game in question, scenarios also become continually more complex as a player ontogenetically develops and a concomitant expansion of tools and strategies emerges to support continued progress. As Gee (2007) has argued, these features catalyze developmentally productive processes that bring together pleasure and learning through a focus on difficult and engaging goal-directed activity.

A related parallel is how feedback is provided; in evidence-informed L2 instruction, correction should be timely and relevant, and evaluative only when meant to be summative. In well-designed games, linguistic feedback is just in time and in the right amount and periodicity, so as not to interfere unnecessarily with gameplay. For L2 learning games, feedback should be integrated and focused on linguistic meaning but also on form. In a design-based study of 83 high school and university students, Cornillie and colleagues (Cornillie, Clarebout, & Desmet, 2012; Cornillie & Desmet, 2013) found that L2 learning-game players prefer, and perform better with, explicit feedback on linguistic form. Based on this research, the authors suggest integrating explicit feedback into game design through interactive conversations with nonplayer characters that give pragmatically appropriate communicative responses to mistakes as opposed to the alternative of recasts or overt punitive actions.

Languaging and Sense-Saturated Coordination

A fifth major affordance that gaming offers L2 learners is the opportunity for languaging, a verbal form of the noun meaning to align and interact linguistically with others in real-time to negotiate and achieve shared goals. In recent scholarship that unites processes of language use with sociocultural inventories of semiotic potential, Thibault (2005) has described language as a "multi-modal contextualizing activity which is embedded in an ecosocial semiotic environment and which integrates diverse space-time scales" (Thibault, 2005, p. 123). This approach contests what has been termed the "code approach" to language as an abstract system independent of human action (Linell, 2009; Love, 2004). By space-time scales, Thibault is referring to an important and often unacknowledged ontological distinction between first-order languaging and second-order language, where first-order languaging describes real-time communicative activity between interlocutors that is irreducible to the "formal abstracta" that is the preoccupation of descriptive linguistics. Importantly, first-order languaging is constrained by "second-order patterns emanating from the cultural dynamics of an entire population of interacting agents on longer, slower cultural-historical timescales" (Thibault, 2011, p. 2). When applied to the analysis of dialogic interaction, the implication is that first-order languaging is phenomenologically primary and that second-order language constitutes historically sedimented semiotic patterns and lexicogrammatical resources that constrain what is possible and enable probabilistically likely and

pragmatically effective choices within a given communicative encounter. In the design of L2 learning environments, a main objective is to provide conditions conducive to first-order languaging. In game-enhanced L2 learning research, Zheng and colleagues (Zheng et al., 2009; Zheng & Newgarden, 2017; Zheng, Newgarden, & Young, 2012) have examined complex languaging dynamics in social MMO gameplay in terms of human players' negotiation for meaning, alignment, and value realization, and also between players and nonplayer characters in the environment. The implications are that languaging opportunities can be cultivated and supported through progressive quest design, random and complementary resource distribution (i.e., structured unpredictability), player and nonplayer character interaction, and the role specialization mechanics that many multiplayer, role-playing, and cooperative games incorporate. As game technologies allow multiplayer and cooperative team designs to be at the center of new game types, such as cooperative survival sandbox games (e.g., *Don't Starve Together; Fortnite Battle Royale*), new affordances for languaging and "sense-saturated coordination" emerge as well (Steffensen, 2013, p. 196).

Identity Performance

Sixth, successful L2 learning requires investment in the performance of identity, often through semiotic work that involves reconciling and integrating multifarious, sometimes conflicting, perspectives, cultures, and understandings of the world. Simply committing to playing games in another language for entertainment and/or for serious (i.e., learning) purposes is itself an investment in new forms of practice that can potentially contribute to the development of linguistic and intercultural competence. For example, Warner and Richardson (2017) show through qualitative case study techniques how a German learner developed as he took on the role of guild leader in a formal classroom game-based activity, struggling with his Bartle gamer style results as a "killer" (Bartle, 1996) but ultimately reconciling his "gamer" identity with that of "learner." Thorne (2012) demonstrated that intercultural encounters are bound to occur in massively multiplayer game worlds and that they can lead to serendipitous opportunities for L2 and culture learning as well as the development of plurilingual textual identities that propagate across related media (e.g., game worlds, strategy websites, and fandom communities). Jeon (2015) showed that Korean English learners developed broader awareness of English as a global language and new identities as L2 English users by playing *League of Legends* on international, English-language servers. The experience motivated her participants to reassess their understandings of the reasons for learning to use English. Finally, research by Rama et al. (2012) indicated that in multiplayer game worlds, a player's gaming expertise and shared goals and affinities were at least as important to other players as language proficiency, although accent and oral language proficiency may play more of a role today in voice chat than when text chat was more dominant.

Independence and Spatial Mobility

A seventh affordance for L2 learning involves game-based uses of mobile devices. A mobile game for L2 learning (e.g., *DuoLingo* and *LingroToGo*) can be played when and where convenient for learners and provides them with agency and control. Here we focus specifically on the use of location-aware mobile devices supporting games designed to be played in particular locations. Locative media, such as smartphones, are ubiquitous across much of the world (Frith, 2015) and have opened up new possibilities for interfacing embodied and virtual experience. Applications of locative media, for example place-based mobile augmented reality (AR), are now used in a variety of educational content areas and have been shown to provide learners with opportunities for investigation-based learning, location-situated social and collaborative interaction, and embodied experience of place (Holden et al., 2015; Squire, 2009; Thorne & Hellermann, 2017). Place-based AR mobile gaming typically involves guiding or drawing players toward specific physical spaces by using GPS locations on a digital map. The AR dimension involves orienting participants' attention to particular places or relevant features of the landscape and then augmenting their experience with semiotic resources, information, tasks, or prompts, with the intention of creating an embodied and experiential in-the-world dynamic for participants.

One of the first games to use AR technology for language teaching (L2 Spanish) is *Mentira*, a place-based mobile game set in a Spanish-speaking neighborhood in Albuquerque, New Mexico, where learners work together to solve a prohibition-era murder mystery. While playing the game, students complete a jigsaw-puzzle-style activity in which each player receives different clues, prompting collaboration to complete the task. Analysis of play records (Holden & Sykes, 2011) found that integrating the orientation tutorial into the game narrative resulted in more time on-task. Additionally, students reported being motivated by their place-based experience in a Spanish-speaking neighborhood, which for some participants included interacting with local residents in Spanish. In another study, Perry (2015) describes an AR game for French called *Explorez*, a quest-style game similar to *Mentira*. Perry reports that students made efforts to speak in French while playing the game and indicated that at times students' efforts to stay in the target language resulted in a "sociocultural learning effect" (Perry, 2015, p. 2313) in which students who were more advanced supported the group with needed vocabulary and correction of language errors. In a study of the place-based AR game *Guardians of the Mo'o*, Zheng et al. (2018) illustrate how "place evokes a learner's effort for making meaning and realizing values through embodied action, collaboration and coordination" (Zheng et al., 2018, p. 55). Adopting an ecological perspective, Zheng et al. argue that "experiencing place is critical for learners to break away from institutional norms and previous thinking patterns in order to develop skilled linguistic action in actual events that lead to prospective actions" (ibid.). This is illustrated via wayfinding activity, such as anchoring their next actions in what is physically present in their environment.

ChronoOps is a quest-type mobile AR game, created and located in Portland, Oregon, that is currently available in seven languages, including English (Thorne, 2013). Participants play the role of an agent from the future. The game begins by describing that in the year 2070, the planet has suffered massive environmental degradation and they (the player-agents) have been sent back in time in order to learn from the green technology projects that are evident on and around the university campus. *ChronoOps* was designed as a series of open-ended and intentionally underspecified tasks with the pedagogical motivation of having players construct their actions as agents in interaction with the game's goals and content. In research on *ChronoOps*, Thorne, Hellermann, Jones, and Lester (2015) used ethnomethodological conversation analysis to investigate how groups of L2 English students sharing one smartphone orient to the device and the information it displays, develop practices for wayfinding, and use talk to bring shared attention to features of their physical surroundings. This research emphasizes the importance of how the game moves the language experience out of the classroom and how the group dynamic around one device influences students' interactional practices. In related research, Hellermann, Thorne, and Fodor (2017) describe the complex interactions associated with the literacy event of reading aloud during mobile AR gameplay, illustrating that collaborative practices for playing the game that involved reading emerged and consolidated over the duration of the activity. Addressing the hypercontextualization and place-based potential of AR, Thorne and Hellermann (2017) analyzed video data of *ChronoOps* gameplay and describe how problems in understanding, as well as moving forward to the next action, are often enmeshed with and supported by the immediate physical environment. Their analysis demonstrates the relevance of embodied and distributed approaches to human activity, illustrating that participants utilize gaze, gesture, vocalizations and talk, pointing, and embodied deixis, in an orderly manner, to coordinate virtual-digital (iPhone) and sensory-visual information, to navigate to the next location, and to complete the oral narration tasks comprising the game. In a study focusing specifically on L2 acquisition, Sydorenko, Hellermann, Thorne, and Howe (in press) employ the widely used construct of language related episodes (LREs) as a unit of analysis. This research illustrates that the mobility and contextual embeddedness of AR tasks create opportunities for just-in-time and situationally driven vocabulary learning, with implications for continuing AR game design and pedagogical structuring of hypercontextualized approaches to language learning.

Autonomy in and through Informal Practices

The eighth and final affordance is related to the preceding discussion in that mobile and geolocation technologies allow more spatial freedom and independence and hence also afford opportunities for autonomous, informal social practices, even when they are part of a structured educational course of study. When L2 learning in much of the world is thought of as a school subject rather than an organic human activity, providing

the resources to autonomously learn an L2 effectively is often an afterthought (though see Little & Thorne, 2017). A digital game is meant to be played in a self-contained way, insofar as once it is launched it should be, for the most part, learnable and playable without any additional support from its creators. At the same time, gamer communities engage in extensive attendant literacy practices around games that extend and support autonomous play. For L2 gaming, however, there may be additional need for linguistic support and pedagogical mediation, and there is demand for games that integrate support for L2 users and learners in the form of optional captions and subtitles, repeatability and time control features, and access to glosses, dictionaries, or other resources, some of which are produced as modifications to the gaming environment by the player community itself.

The reality is that millions of individuals learn L2s informally in order to play games, but often these practices go unrecognized and unsupported by practitioners of L2 pedagogy, such as teachers, and SLA research. Research shows the complexity and diversity of these informal practices, especially as they involve considerable interaction with gamer communities in multiple languages (Chik & Ho, 2017; Vasquez-Calvo, 2018). For example, in a case study, Vasquez-Calvo (2018) describes how a first-language (L1) Spanish participant in several online affinity spaces focused on gaming and game translating to informally develop proficiency in English. The focal participant autonomously contributed to a variety of forums, offering microtranslations and corrections to other translations of English-language games, taking on a variety of roles (e.g., gamer, reader, fan translator) and engaging in a wide range of literacies that involve enhanced linguistic and IT skills.

An Agenda for Research, Pedagogy, and Design Focused on L2 Learning Dynamics

SLA recognizes several major theoretical perspectives on language learning, each of which can be aligned with ontologies of language and literacy, implicating particular L2 pedagogies and game designs. First, a structural view understands language as structure that is acquired through translation, transfer, and repetitive practice, aligning with behaviorism and both grammar-translation and audiolingual L2 teaching methods. In the design of game-based L2 learning, repeated exposure, positive and negative reinforcement, explicit feedback on form, and translation-focused activities (e.g., as with popular language learning app *DuoLingo*) align with structural views. The second perspective, psycholinguistic-cognitive, recognizes the active role of cognitive processing and memory in the individual mind of a learner. Aligned with this perspective, the input-interactionist view of SLA (Long, 1983) maintains that input must be partially comprehensible, gaps noticed, and meaning negotiated among interlocutors in order to facilitate acquisition. In game-based learning design, a psycholinguistic-cognitive view implicates providing opportunities for immersion in partially comprehensible

narratives, noticing and production of meaningful language use, and interaction and negotiation of meaning. The sociocognitive perspective includes a range of theories (Atkinson, 2011) that encompass Vygotskian sociocultural theory, language socialization, identity-focused theories, and Bakhtinian dialogism, all of which, in generally commensurable ways, emphasize social-relational dynamics and learning as a function of changes in forms of participation as foundational to language use and development (Lave & Wenger, 1991; Sfard, 1998). In game-based L2 learning design and research, these approaches implicate facilitating multiplayer interaction and collaboration, role-play, learning as a culturally shaped activity, and participation in player communities.

In addition to drawing implications from a priori theoretical stances, the aforementioned discussion of affordances may offer a cohesive research agenda focused on the L2 learning dynamics that emerge in and around gameplay as specific designs interact with player characteristics (e.g., age, linguistic proficiency level, gaming experience) and contextual variables (e.g., classroom environments, experimental conditions, informal recreational play). Research that focuses on the relationships between specific game design features and player languaging behavior in recreational gameplay (including their associated socioliteracy practices) can ultimately inform the design of game-enhanced pedagogies (e.g., supplemental materials and soft modding designed to amplify L2 learning. Moreover, these findings can ultimately inform the design of educational-game–based L2 learning environments and pedagogical practice.

Contextualization

With regard to the contextualization affordances of game spaces, specific research questions might ask how incidental and intentional learning processes, narrativization, interactivity, and identity contribute to form-meaning-function associations and learning. In emerging AR and virtual-reality contexts, for example, there may be heterogeneous player responses to its potential for deep situational and emotional immersion, and thus cognitive and memory loads may be so high as to inhibit learning, while for other players or with different event scenarios and tasks, it may support learning. This new context for research on L2 learning, especially given the prevalence of smartphone usage by individuals and groups for a wide array of informational, communicative, and navigation practices, warrants continued investigation.

Time

Experimental studies using cognitive and working-memory load theory (DeHaan, Reed, & Kuwada, 2010) may offer insight into how game mechanics can scaffold language comprehension and production, accuracy, and fluency, by means of game task design and feedback provisions. There is a need for descriptive studies examining how L2 gamers in the wild leverage time affordances and to what extent that manipulation (e.g., to repeat or translate a dialogue) might impede or augment game enjoyment.

Shelter

One potential research area is to examine how well-designed games push players to challenge themselves and increase proficiency while building autonomy, without engendering overdependence on scaffolding. Research on more formal game-based instruction might inquire how game modifications, learning task parameters, and supplemental materials can serve to scaffold and provide a sense of shelter, raise willingness to communicate, and lower anxiety through their design, for example by providing opportunities for "graceful failure" (Plass, Homer, & Kinzer, 2015).

Goals

There is a need for more research on how the interface design of a game—whether recreational or educational in its purpose (understanding that these are not mutually exclusive categories)—supports learning (i.e., supports orientation toward L2 learning goals and uses supplemental resources without being overly didactic, which is a problem with educational games). Research might ask to what extent (i.e., when and how) a game should offer glosses for vocabulary; player control of annotations, translations, and captions; repeatability and control of time mechanics; or access to external metalinguistic resources (e.g., grammar aids, pragmatics strategies). Features that support using a game for learning are typical of some titles in some genres, and some games provide access to help features and player guides within their interfaces, while others make it more difficult or rely on the player's use of resources external to the game. Additional empirical and usability studies correlating types of language-learning supports and forms of feedback with learning outcomes is needed, a process that has been initiated in intelligent computer-assisted language learning environments (Heift, 2013; Heift & Vyatkina, 2017).

Languaging and Collaboration

An overarching question implicated by research asks how game-based languaging is afforded by task parameters, which relates to learning mechanics as described in Plass, Homer, Mayer, and Kinzer (chapter 1 in this volume) (e.g., whether they are open ended or single outcome), by task function (e.g., whether they involve planning, problem solving, brainstorming, or strategizing)—or by task configuration (e.g., whether they are collaborative, cooperative, conjunctive, or competitive). There is a considerable amount of research on task-based teaching and learning to draw on that already explores how task design relates to L2 learning affordances but not under gameplay conditions. A group collection task in an MMO might afford opportunities for language use that are quite different from those in a survival game where time pressure compels players to differentiate and assign roles, or in a mystery-themed escape game where players must coordinate actions and collaboratively deduce the meanings of clues. In these varying conditions, unique interactional discourses emerge that warrant empirical investigation.

Identity

Storymaps (spatialized narration with maps; e.g., Neville, 2015) or *alterbiographies* (emphasizing story generation emerging in gameplay rather than scripted story telling; e.g., Calleja, 2011), among many other game-enabled actions and affordances, develop in unique narrative trajectories for each player each time a game is played, but how these develop and integrate, especially insofar as they involve L2 language use, has not been well investigated. Researchers might ask how players engage in identity work and play, and how this is reflected in expressions of alterbiographies—a game journal, an interview, or a debriefing, for example. Interventions might use serious or educational games that present opportunities to experience events or contexts from different perspectives and assess learner development of intercultural competence or emotional literacies. Research might explore how particular design mechanics and contextual dynamics afford perspective taking and value realization, and how those interact with identities and backgrounds external to the game.

(In)dependence

The affordances for L2 learning offered by network, mobile, AR, and other very new digital technologies (at the time of this writing) for new kinds of place- and time-independent and place-bound learning implicate new possibilities for research, instruction, and design, especially when viewed in conjunction with affordances for languaging and social collaboration.

Autonomy

Learners increasingly need autonomous learning skills to make critical use of the wide variety of game-based L2 learning tools available—knowing how to learn both on their own and with others in intercultural interaction, as well as how to self-direct and assess their own learning. Research should continue to explore game-based L2 learning practices to identify how formal instruction might complement and support them. Perspectives on games as media (Hjorth, 2011), socially attuned and ecological frameworks, and microinteractional learning sciences approaches are especially useful for such research. The attendant discourses, paratexts, communities, and socioliteracy practices associated with gaming defined broadly offer rich sources and spaces for inquiry, and as new practices emerge, so do new opportunities for research.

Limitations, Challenges, and Opportunities

Speaking to game-based and game-enhanced language learning, Sykes and Reinhardt (2012) observe that there remains an outstanding need for large-scale studies that include "psychometric instruments, pre-post measures of learning outcomes, systematic observation and analysis of real-time gameplay, and perceptive measures such

as interviews, focus groups, and surveys" (Sykes and Reinhardt, 2012, p. 113). The design and implementation of such large-scale mixed-methods studies would allow researchers to more finely assess game-based L2 language use and learning from multiple perspectives, to assess and compare developmental trajectories of participants within, and potentially across, game genres, and to measure the effects of particular forms of gameplay on language retention. Such research could also inform language instructors' choice of recreational digital games for L2 learning and the design of L2 learning-purposed games, and could potentially contribute to amplifying game-based and game-enhanced learning outcomes through instructional mediation and activities. To our knowledge, such mixed-method, large-scale studies have not yet been carried out, leaving open many prospects for future research.

Much of the current empirical research on game-based L2 learning and pedagogy does not include participant numbers large enough to generate statistically significant findings. In addition, there is a dearth of interaction between L2 practitioners and researchers and game developers, who may lack understanding of how SLA principles interact with game mechanics. Moreover, educational publishers are necessarily invested in products that look to the consumer like they are effective, whether or not their effectiveness has been thoroughly evaluated. Last but not least, research on L2 use and learning in 3-D multiplayer environments is simply challenging for a number of reasons. The spatial and semiotic complexity of game worlds makes necessary a wide and highly complex array of methodological approaches, including multimodal analysis and ethnomethodological attention to the sequential organization of player actions, interactions, and engagement with texts and artifacts in the game environment. Additionally, virtually all popular multiplayer games include attendant strategy, lore, and fandom paratext sites, the use of which can be interwoven with real-time gameplay, presenting challenges to data collection. As suggested by Plass et al. in reference to game-based learning at large, "the integrated viewpoints of cognitive, motivational, affective, and sociocultural perspectives are necessary for both game design and game research in order to fully capture what games have to offer for learning" (Plass et al., 2015, p. 278).

At the same time, there is growth in smaller-scale, qualitative studies of informal game-enhanced learning, often using ethnomethodological and discourse-analysis approaches, as well as studies reporting on the development and application of local, customized game-based applications. These studies, some of which have been reported on here, take innovative approaches to combining research methodologies, L2 learning theories, and game design principles, forging new ground. An underexplored but promising area involves gaming literacies, in particular design literacies (Reinhardt, Warner, & Lange, 2014; Zimmerman, 2007) and their relationship to L2 learning. Innovative examples of gaming literacies research and pedagogical interventions exist (Butler, Sumeya, & Fukuhara, 2014; DeHaan, 2011; Lacasa, Martínez, & Méndez, 2008; Steinkuehler,

2007), but there is ample space for continued exploration of gaming as a translingual and intercultural global practice (Warner & Richardson, 2017). Gaming literacies can be instructionally facilitated by designing and building games (Howard, Staples, Dubreil, & Yamagata-Lynch, 2016), by critically considering the function of games and game culture in society, and as learning environments and affinity spaces that are organized in a distinctly different way compared to conventional instructional models. As new technological innovations lead to new game types and genres, new areas for exploration and research open; for example, language acquisition research is incipient in regard to multiplayer cooperative games, virtual- and augmented-reality games, pervasive and urban games, and hybrid game genres. Attendant practices such as gamer fandoms (Sauro, 2017; Vasquez-Calvo, 2018) are just now being investigated, and nothing in the literature has yet reported on eSports or Twitch streaming, which by all accounts are highly translingual and global practices. In sum, opportunities for innovation in game-based L2 learning—theoretical, methodological, pedagogical, and design—abound.

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