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Digital Games and Technology-Mediated Gameful Environments

for L2 Learning and Instruction

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Introduction

In the illustrated essay *A Theory of Fun for Game Design* (2005)*,* game designer and critic Raph Koster traces the mechanisms that underlie the fun which human beings experience when they play games, irrespective of whether these are analogue (such as boardgames) or digital (computer, video, or mobile games). He hypothesizes that fun does not primarily arise from the continuously evolving formats for interaction, nor from the technological inventions that enable games to deeply immerse players in a task through all their senses, but from the innate disposition of human beings to actively construe and comprehend patterns in the reality that surrounds them. Games are, according to Koster, "iconified representations of human experience that we can practice with and learn patterns from" (2005, p. 36). In order to survive and thrive as a species, human beings are wired to learn to recognize patterns of various kinds, such as human faces, geometrical forms, natural language, musical motifs and genres, and social conventions in interpersonal interaction. Mastering such patterns releases endorphins into the brain, which delivers the experience of 'fun'. In contrast with everyday life, however, games are *engineered* experiences: they allow players to interact with patterns in a manner that is *immediate* (whenever players want), *consistent* (with a certain level of predictability and fairness), and *dense* (providing plenty of opportunities for autonomy satisfaction and high volumes of mastery feedback), which produces and maintains engagement in accumulating amounts (for discussion see Rigby & Ryan, 2011, pp. 9–13). As a result, players can be hooked

on games, until they master the patterns and lose interest. In other words, "with games, learning is the drug" (Koster, 2005, p. 40).

When we look at the design of gaming environments from this perspective, playing a game can in essence be considered an addictive learning experience, and it is easy to explain why digital games, too, have always attracted attention from educators, instructional designers, and researchers in the learning sciences and instructional technology, including in the fields of foreign and second language (L2) learning and teaching, second language acquisition (SLA), and Computer-Assisted Language Learning (CALL). For example, Gee (2007) observed that digital games exhibit design principles that are hypothesized to effectively support learning and literacy development, such as the embedding of the meaning of signs (words, symbols, texts) in situated and often embodied experiences (in contrast with decontextualized meaning representations such as dictionary entries), the ordering of tasks in incremental levels of difficulty, the encouragement of risk-taking while lowering real-world consequences, and the voluminous provision of intrinsic rewards that emphasize achievement at all levels of skill. It has also been noted that games resound remarkably well with the pedagogy of task-based language teaching (TBLT), where the L2 is used meaningfully and functionally while attempting to achieve non-linguistic objectives (García-Carbonell, Rising, Montero, & Watts, 2001; Purushotma, Thorne, & Wheatley, 2009; Sykes, 2014; Sykes & Reinhardt, 2013).

In comparison with other areas of the educational curriculum or of human development more generally, the potential of games for L2 teaching and learning is unique. Analogue and digital games enable players to engage with language not only by interacting with game content, but also through communicative activity with other players during gameplay, and in the discursive practices that emerge in the broader (nowadays often technology-mediated) ecologies that surround gameplay. Empirical studies have documented such practices in, for example, wiki sites where players share effective strategies for progressing through games

(Thorne, Fischer, & Lu, 2012), live streaming platforms (Payne, Keith, Schuetzler, & Giboney, 2017), and online fan communities where gamers translate or modify their favourite games, or write fanfiction on them (Vazquez-Calvo, Zhang, Pascual, & Cassany, 2019). Patterns of language and communicative interaction can thus emerge not only from the game content, but also from how games are being played, discussed, and transformed collaboratively. As a result, even games that do not have any linguistic content built into their design can facilitate L2 learning. As we will see, it is equally worth looking beyond their inherent design and formal properties into how games are being used for (informal) L2 learning, and how they can be pedagogically repurposed with a view to driving L2 learning in instructed contexts.

It is critical to note that research on the design and use of technology-mediated gaming environments for L2 learning and teaching is heterogeneous, drawing on a wide variety of game types, contexts of use, and theoretical frameworks in SLA and beyond. Arguably, this complexity is in great part due to the fact that the concepts 'game' and 'play' are elusive—even if the terms are intuitively well-understood and used with ease in everyday conversation—and to the general lack of consensus about what exactly constitutes games and play, including in the field of L2 teaching and CALL research. This will be discussed in the next section.

Definitions

Definitions of 'game' and 'play' vary depending on whether these are considered in isolation or in relation to the player and their broader sociocultural context. At one end of the spectrum, theorists have tried to pin down games as formal systems in their own right; for example: "a game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2004, p. 80). However, when trying to further formalize such structuralist conceptualizations, there is little agreement about the classification of games, nor about their constitutive features. Are points systems essential in games? Is an

interactive 3D puzzle without narrative and competition truly a game or simply an exercise for the brain? Can text-only digital interactive experiences be considered games? What about *choose-your-own-adventure* books, the analogue counterpart to digital games? Wittgenstein (1953) observed that games can be best thought of as a family resemblance: there is not a single characteristic or list of characteristics common to all games, but only a set of overlapping similarities that motivates us to conceptually group all instances of games under the same denominator.

Questions about the constitutive design elements of games are important for CALL practice, because what one teacher (or learner) might call a game might to another simply be a rote memorization activity with pictures online. They are also important for CALL research (see also section 5.3). A case in point is Loewen et al. (2019), who position their study on Duolingo in the area of mobile assisted language learning rather than in game-based learning. Regardless of whether Duolingo should actually be treated as a game or not, such cases show that choice of terminology can impact the accumulation of knowledge, notably if such a study is consequently excluded from a systematic review or meta-analysis.

More holistic definitions take into account the complex ecology in which games and playful experiences are embedded. Huizinga's (1955) canonical definition highlights the subjective, voluntary, futile, and social nature of games and play:

> a free activity standing quite consciously outside 'ordinary' life as being 'not serious', but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. It promotes the formation of social groupings which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means. (p. 13)

Elements of this characterization equally pervade the CALL literature on gaming, including the sociocultural affordances of the medium and the importance of considering the player's disposition towards a game. More specifically, it may not suffice to augment a CALL activity with rewarding systems, time pressure, a narrative, and other design features traditionally associated with games; ultimately, "it is how the learner views [the activity] that will determine whether it is used as one" (Hubbard, 1991, p. 221).

In recent years, the term *gameful* has been coined to reflect the idea that games and play are increasingly intersecting with everyday life—note the contrast with Huizinga's definition—through affordances catalysed by mobile, wearable, and ambient technologies as well as ludic design patterns, concepts, attitudes, and practices. *Gamification,* i.e. the use of game design elements in non-game contexts, is perhaps the most widely-known trend associated with this evolution. However, gamefulness is conceptualized more broadly as "the use of games and play beyond leisurely entertainment along two dimensions: wholes versus elements or qualities, and *paidia* [open, free, exploratory play] versus *ludus* [goal-oriented play bound by rules]" (Walz & Deterding, 2014, p. 7).

The second main factor that determines the heterogeneous nature of research on gameful L2 learning and teaching relates to the intended purpose of games (decided upon during their design and development) and to their context of use. A key difference is between games primarily intended for entertainment, known as (commercial) *off-the-shelf* games in the wider educational literature and sometimes as *vernacular games* in CALL, and *educational games* purposefully designed for L2 teaching and learning[i]. Off-the-shelf L2 gaming occurs and is being studied, first, in naturalistic, non-instructed L2 learning contexts, when the primary purpose of play is entertainment rather than L2 learning. It can generate experiences that involve genuinely meaningful L2 use in scenarios that resemble those of task-based pedagogy, such as interactive reading (games as texts/linguistic resources) or communicative interaction

(games as catalysts for social interaction). In CALL research and practice, however, vernacular games are often pedagogically repurposed. This consists of supplementing gameplay with wrap-around materials such as vocabulary lists and activities for reflection, or modification of the digital artefact itself, for example rewriting game quests in order to better match curricular objectives (for examples see Table 1, column 'game-enhanced'). While L2 researchers are concerned with finding out what works for L2 development in vernacular gaming and why, language teachers have a key role to play in the repurposing of off-the-shelf games for instructed L2 learning, building on insights from research.

In contrast with off-the-shelf games, games of the educational kind clearly exhibit an L2 *teaching presence* (Hubbard & Bradin Siskin, 2004)[ii], for instance through (automated) evaluation of how learners use the L2, and language-focused feedback, and are therefore, as a standalone tool, more suitable for formal L2 learning. Their design, however, critically requires collaboration between SLA specialists, instructional designers, and game designers to successfully wed ludic engagement with educational effectiveness.

To refer to the different purposes and contexts of practice and research in L2 gaming, Reinhardt and Sykes (2012) proposed the terms *game-enhanced, game-based*[iii] and *game-informed.* These concern, respectively, the use and repurposing of vernacular games for L2 teaching and learning, the design and implementation of educational games, and the informed application of theories of game and play in L2 teaching and learning contexts not conventionally associated with games (including but not limited to gamification) (see also Reinhardt, 2019).

To conclude this section, we exemplify the different design purposes and contexts of L2 gaming in relation to four categories of technology-mediated gameful environments through research projects and pedagogical implementations (see Table 1). The cells in this table largely overlap, as the categories of gameful environments are not necessarily mutually exclusive, but foreground different elements of game and play even if many elements are shared between

them. The overview is therefore not intended to be exhaustive or reductive, but to raise an appreciation of the complexity of the field and to support understanding the many approaches that are being taken to examining the relationship between gaming and L2 learning and instruction, as well as to implementing gaming in L2 teaching contexts. As research on game-informed L2 teaching and learning is only just emerging, we provide ideas for pedagogical implementations instead of published studies (but see Cruaud, 2018; Stanley, 2014).

The first category is comprised of *immersive games* (also coined *synthetic immersive environments* in the CALL literature): standalone and sensorially rich 2D or 3D virtual simulations that afford multimodal goal-oriented interaction with content and often also with other players. These also include (massively multiplayer online) role-playing games ((MMO)RPGs), in which human players and computer agents assume the identity of fictional characters (*player characters* and *non-player characters*, respectively). The second category, *interactive fiction* (IF), can be best described as a type of story with which the reader interacts, that is typically non-linear, and is told mainly through text. Many works of IF share characteristics with immersive games, such as a focus on narrative and character development, but IF typically is less multimodal and does not involve multi-player interaction[iv]. Third, *location-based gaming* refers to structured play that takes place in physical spaces, enabled by mobile devices. Its affordances can be very similar to those of immersive gaming, but location-based gaming foregrounds physical space: technology is used to augment and interact with the tangible world rather than to simulate virtual reality spaces. The final category includes *mini-games*: games that can be played casually in short sessions (often single-player and on mobile devices) and which can be embedded in larger games or wholes. With regard to L2 learning, mini-games are probably best known in educational formats, and their pedagogy is quite different from that of the former three categories: their use aims to primarily improve learners' mastery of discrete L2 constructions (vocabulary items and grammatical structures) through

part-task practice, rather than support the learning of more complex skills (Cornillie & Desmet, 2016).

Table 1

Illustrations of types of gaming environments in relation to their design purposes and contexts

Type of gaming environment	Design purpose and context		
	Game-enhanced (repurposing vernacular games for L2 learning)	Game-based (designing L2 educational games)	Game-informed (infusing other L2 materials and activities with insights on games and play)
Immersive game	Reinders and Wattana (2014) modified *Ragnarok Online* by adding quest events appropriate for their learners' proficiency levels and in line with their learning objectives.	*Tactical Language and Culture Training System* (Johnson, 2007) trains U.S. military forces to communicate safely, effectively, and in culturally appropriate ways in languages of the Middle East.	Sensorially rich simulations in classroom contexts (e.g. Total Physical Response) augmented with narratives and points systems
Interactive fiction game	Lee (2019) examined how the detective IF game *Her Story* served creative writing and motivation.	*Ausflug am Wochenende nach München* teaches German L2 vocabulary, reading, and culture to university students (Neville, Shelton, & McInnis, 2009).	Identity play and gamified creative writing (e.g. *StoriumEDU*)
Location-based game	Students keep an exploration journal while playing Pokémon GO (Seifert, 2017).	Games like *Mentira* (Holden & Sykes, 2011) and *Paris Occupé* (Pegrum, 2019, pp. 147–151) encourage L2 learning through place-based interaction with (local) communities and histories.	Collaborative linguistic landscaping tasks for intercultural learning informed by the design of multiplayer RPGs

| Mini-game | Mawer and Stanley (2011) show how games without words like *Orbox* can be repurposed for drilling directions, prepositions and other lexical items (see also Cornillie & Desmet, 2016). | Currently, *Duolingo* can be considered mostly as a gamification of grammar translation pedagogy. | Using *Quizlet and Classcraft* for drilling L2 vocabulary embedded in collaborative quests in the classroom |

Historical Perspectives

Digital games have long been the subject of research and practice in L2 learning. Indeed, as early as 1987, it was noted that most activity in the area of CALL at that time was inspired by 'the games model': an approach to the design of CALL software that favours learning activities which are worth doing for their own sake—engendering intrinsic motivation—rather than for some external rationale, and which involve competition and a set of rules to which participants must adhere (Phillips, 1987).

In the last two decades, however, academic interest in the use of digital games for L2 research and practice has reached a peak (for overviews see Cornillie, Thorne, & Desmet, 2012; Hung, Yang, Hwang, Chu, & Wang, 2018; Peterson, 2010; Poole & Clarke-Midura, 2020; Reinders, 2012, 2017; Reinhardt, 2017, 2019). On the one hand, this has most likely been the result of a diversification of game types and audiences in the commercial game industry, in combination with the rise of online platforms for the distribution and collaborative play of games (Cornillie et al., 2012; Reinhardt, 2017, 2019). Consequently, for many learners, digital gaming has become an accessible and significant source of contact and interaction with an L2 and its users outside formal learning contexts, mainly for English but also for other languages. On the other hand, the surge of interest in digital gaming has gone hand in hand with a post-structuralist reconceptualization of technology-mediated L2 learning that highlights the value

of socialization, co-creation, and multiliteracy practices in a complex interconnected digital world, beyond the mastery of language as a subject of study and mere utility for communication.

A second trend typical of the last two decades is the numerical increase in rigorous empirical studies on gameful L2 learning and instruction (see systematic reviews by Cornillie et al., 2012; Hung et al., 2018; Poole & Clarke-Midura, 2020). These comprise both highly descriptive work that is largely qualitative in nature, and studies that adopt experimental and quantitative research designs with a view to examining impact on learning.

Critical Issues, Topics, and Methods for Research

The multifaceted nature of games and play (see section 2), of language, and of learning (see section 3) requires a broad and theory-driven research agenda aimed at scrutinizing how gameful L2 learning can advance the development of linguistic, social, and multiliteracy skills (New London Group, 1996). This involves establishing three key bodies of knowledge (which will be reviewed in the next section): empirical evidence with respect to how gameful technology-mediated interaction is associated with general indices of L2 development (such as lexical proficiency), a thorough understanding of affordances (Blin, 2016) of gaming for L2 learning, and an evidence-based model of how design elements of gameful environments can be leveraged for effective L2 learning and instruction.

As for the first topic, if games are considered as texts or communicative tools through which learners interact with an L2 and its users, it may seem futile to examine whether (informal) learning in (vernacular) gaming environments is associated with general indices of L2 development. Like any other type of media involving L2 use (for example, subtitled video), it is obvious that learning in gaming environments will occur to some extent if the L2 is comprehensible and exposure to it abundant. The essential empirical question, necessitating

both descriptive and experimental research designs, is how game-mediated L2 learning relates to learning through other types of media, and which aspects of L2 development gaming actually fosters, in particular complexity, accuracy, and fluency in the four skills, as well as functional adequacy (e.g. Pallotti, 2009). A focal issue here is whether learners can transfer their learning from gaming ecologies (games and their associated discursive spaces, such as online fora and fan sites) to non-gaming contexts, as gaming worlds evoke linguistic registers (including specialized vocabulary and communicative conventions) as well as kinds of interactivity that may be dissociated from those of more canonical contexts where learners use the L2.

A second component consists of descriptive work that identifies affordances of gameful L2 learning in the context of the broader ecologies in which games are embedded, for example through ethnographic studies. As authentic gaming ecologies can be rather different from other settings of informal or instructed L2 learning—for example the ways in which collaboration with peers is engineered—such research is necessary in order to uncover the specific conditions that drive L2 learning in these environments, as well as the design elements inherent in them that can constitute conditions for successful learning.

Finally, powered by a thorough understanding of gameful affordances, meticulous experimental work (ideally with quantitative or mixed-method research designs) is needed in order to move the field beyond making claims about the general benefits of gameful L2 learning towards providing tested and generalizable empirical models of how particular game features, like feedback systems or collaborative task designs, can induce particular learning outcomes on three interacting levels of the L2 psychological system: (meta-)cognitive, motivational, and affective/emotional (for an overview see Dörnyei, 2009, pp. 200–229). Accumulated evidence in specific contexts about the impact of particular game features on L2 learning and on its mediating factors can then potentially be generalized to other game types and contexts, and

even to the design of game-informed classrooms. In this way, the conditions of effective gameful L2 learning can be engineered rather than left to occur by chance.

Naturally, it is critical that the research agenda outlined above is accompanied by theories in SLA and related fields of behavioural science, in particular cognitive, educational, behavioural, social, and motivational psychology. First and foremost, we need operational models of what is considered successful L2 learning and of the factors by which it is catalysed. Cognitive theories and hypotheses of SLA are obvious angles of attack if the object of study is how games afford opportunities for L2 input, output, and interaction. On the other hand, socioconstructivist accounts can help to explain, for example, how learners move from other- to self-regulated L2 learning in cooperative play. In addition, since goal-oriented play is regarded as voluntary in nature and hence driven primarily by intrinsic motivation—a type of motivation considered a "natural wellspring of learning", achievement, and creativity (Ryan & Deci, 2000)—extensively validated theories of human motivation such as self-determination theory (SDT) are pivotal to the research agenda. A final set of relevant theories are those that aim to account for the role of affective variables in L2 learning, such as anxiety.

Current Contributions and Research

Research on digital games and gameful environments for L2 learning has addressed the three focal topics outlined above, leveraging a wide range of methodologies used in the fields of SLA and CALL, ranging from predominantly qualitative methods in (ethnographic) case studies and action research, to primarily quantitative methods in correlation studies and lab-based experiments. Hung *et al.* (2018) report that half of the 50 studies in their scoping review adopted a mixed-method research design.

Evidence of L2 Learning

Research examining the relation between gaming and indices of L2 learning has taken place in naturalistic contexts and in more controlled settings, mostly for L2 English settings and with a particular focus on lexical proficiency (Hung et al., 2018; Poole & Clarke-Midura, 2020). To a more limited extent, automatization (a component of fluency) has been studied. The role of mediating variables at a metacognitive, motivational or affective level has also been the subject of research.

Studies on digital gaming in leisure contexts with relatively large sample sizes have revealed rather unsurprising but fairly robust associations between frequency of playing and lexical knowledge in L2 English (Hannibal Jensen, 2017; Kuppens, 2010; Sundqvist, 2019; Sylvén & Sundqvist, 2012). Additionally, Sundqvist (2019) found that gamers demonstrated knowledge of vocabulary that is infrequent and sophisticated—both characteristics of L2 complexity. While the research design of these studies precludes uncovering the direction of the correlation and hence drawing conclusions about learning, it is intriguing that the results apply to (very) young learners who had received very little formal instruction in English as L2. Equally interesting is the finding that vocabulary scores are related to gaming with multimodal input and written input only, but not to gaming with oral input only (Hannibal Jensen, 2017)— this finding also applies to contexts beyond gaming (e.g. Vidal, 2011)—and that there are gender differences, with boys both spending more time on online gaming and scoring higher on vocabulary tests (Hannibal Jensen, 2017; Sylvén & Sundqvist, 2012).

Meta-analyses show that in more controlled research settings, gaming can indeed favour the learning of vocabulary, with medium to large effect sizes in comparison with more conventional teaching approaches (Chen, Tseng, & Hsiao, 2018; Tsai & Tsai, 2018). Moreover, the effectiveness of gaming for vocabulary learning seems to depend on the extent to which comprehension of particular lexical items is instrumental to making progress in the game,

thereby lending support to the Involvement Load Hypothesis (Shintaku, 2016; for a review of earlier studies and theoretical discussion see Cornillie, Jacques, De Wannemacker, Paulussen, & Desmet, 2011).

Further, there is evidence that intensive practice with educational mini-games can result in increased automaticity with respect to lexical retrieval (Cobb & Horst, 2011), knowledge of complex grammatical constructions (Cornillie, 2014; Cornillie, Van den Noortgate, Van den Branden, & Desmet, 2017), and speech rate (Grimshaw & Cardoso, 2018). Moreover, these studies show that the effects of such practice may transfer to more complex and communicative tasks such as oral storytelling and roleplay.

Adopting a dynamic systems theory approach, Scholz and Schulze (2017) found that German L2 learners were able to transfer knowledge of linguistic constructions from their extramural engagement with the MMORPG *World of Warcraft* to non-gaming contexts. This demonstrates that non-instructed learning in more complex off-the-shelf games, of which the benefits for L2 learning are sometimes contested, can indeed support L2 development. The study is also worth mentioning for its operationalization of dynamic systems theory. In an ecologically valid gaming context, it longitudinally mapped the individual trajectories of 14 learners who played *World of Warcraft* in their pastime, collected a wide range of measurements such as surveys and interviews, log files of game activity, and out-of-game group discussions of gameplay experience. It correlated events in the trajectories of learners within and outside the game to look for evidence of L2 learning and implemented retrodictive qualitative modelling to causally trace back signatures of learning.

Lastly, guided by the assumption that L2 learning is mediated by metacognition, motivation, and affect, studies have examined variables such as perceived benefits for learning, intrinsic and extrinsic motivation, and willingness to communicate (for overviews see Hung et al., 2018; Poole & Clarke-Midura, 2020). A consistent finding in this area is that gaming has

positive effects on willingness to communicate (e.g. Reinders & Wattana, 2014, 2015), suggesting that playful engagement in the L2 can lower affective barriers in communicative tasks.

Affordances for L2 Learning

As noted in the introduction, the affordances of technology-mediated gaming for L2 learning have been primarily related to TBLT pedagogy. More specifically, gaming environments can satisfy the six criterial features of TBLT as identified by Rod Ellis (2003). Table 2 outlines these in relation to both conceptual and empirical work utilizing in particular ethnographical and conversation-analytic methodologies (for discussion of these methods see Reeves, Greiffenhagen, & Laurier, 2017).

Table 2

Affordances of gaming environments vis-à-vis criterial features of TBLT

Criterial features of TBLT (Ellis, 2003)	Affordances of gaming environments
A task is a workplan …	Games entail structured and goal-oriented play (*ludus*), bound by scenarios, rules and mechanics. This contrasts with play in more open-ended (yet still task-based) environments like virtual worlds (Cornillie et al., 2012; Reinhardt, 2019), although these can also be modified to add more goal-orienting.
that has a clearly defined non-linguistic outcome …	Players are primarily oriented towards non-linguistic objectives, such as completing *quests* (e.g. fetching an object), solving puzzles, or obtaining high scores. In the process, they receive ample feedback, which is usually non-linguistic (signalling failure or achievement at various stages during problem-solving).
and is intended to call primarily for meaning-focused language use …	In order to achieve non-linguistic outcomes, players use language (form-function-meaning mappings) meaningfully or communicatively, in interaction with other players (see review of Peterson, 2016). Language is to a large extent learned incidentally. Decontextualized explicit instruction of language as a system of symbols and rules does not come into play, but

	focus on linguistic form can occur within meaningful language use whenever relevant or needed, for example through playful repetition and modification of linguistic chunks (Piirainen-Marsh & Tainio, 2009), language-related episodes (Thorne, 2008) or corrective feedback (Cornillie, 2017).
that engages cognitive processes such as reasoning and evaluating information …	Complex higher-order thinking and processing of symbolic information (such as depictions and descriptions of objects to manipulate, and quest texts with objectives and directions) in situated experiences (Gee, 2007) is part and parcel of problem-solving in games. The meta-analysis of Chen *et al.* (2018) shows that vocabulary learning in games that create such conditions is significantly more effective than vocabulary learning in more constrained mini-games.
and involves any of the four language skills (or a combination thereof) …	Interaction with game content, fellow players, and resources and communities around games can serve learning the four language skills (e.g. García-Carbonell et al., 2001).
as well as processes that reflect those of real-world communicative language use.	While games may comprise contexts, scenarios, and language (e.g. Thorne et al., 2012) that differ from those of 'real-world' situations (e.g. fantasy settings, unlikely events, and rare lexical items and formulaic expressions, respectively), the processes involved in language use are largely similar (Peterson, 2016). Learners also engage in patterns of interaction that are essential for communication yet often not part of traditional classroom instruction (Gonzalez-Lloret, 2019).

In addition to these more linguistically-focused benefits for L2 learning, (online) gaming can strengthen social and collaboration skills (see overviews of Hung et al., 2018; Peterson, 2016). For example, Zheng, Newgarden, and Young (2012) showed that killing virtual characters can coincide with caring for the players by whom these are enacted. Further, action research shows that digital gaming is compatible with a multiliteracies approach in the language classroom (Beavis, 2013), focusing on the development of complementary skills such as creativity, performance literacies, critical thinking, and computational thinking. Cases in point are Lee (2019), who demonstrated that the open-ended nature of the interactive fiction game *Her Story* helped university students to write creatively in L2 English, and Cornillie et al. (2021), who found that secondary education students developed language, literary and ICT skills as well as transversal competences when collaboratively writing interactive fiction around the universe of the game series *Assassin's Creed*.

Impact of Design Elements on L2 Learning

To date, relatively few studies have examined the impact of experimentally controlled design elements in gameful environments for L2 learning, arguably because in-game manipulation and measurement of variables is technically and methodologically complex, but also due to the lack of a widely-accepted conceptual framework on gameful design elements. Therefore, researchers have mainly anchored their experimental studies in theories in the learning sciences that consider the role of widely studied features of instructional environments such as interactivity, learning support, and feedback.

deHaan et al. (2010) showed that game interactivity—the medium's quintessential feature—may not always be beneficial, and can even induce extraneous cognitive load that hampers L2 learning. However, other work has shown that interactivity can also offer contextualized support that aids L2 learning and motivation. For example, the availability of supplementary word lists can help learners to better pick up words while playing simulation or adventure games (Ranalli, 2008; Shintaku, 2016). Also, in-game glosses that induce less involvement load have been found to positively impact vocabulary learning (Rasti Behbahani, 2020). Further, empirical studies have found that L2 learners are receptive to and benefit cognitively from feedback on linguistic form in gaming environments, and that playful elements embedded in such feedback can simultaneously support their intrinsic motivation (for a review see Cornillie, 2017).

Finally, there is evidence that the addition of competition and reward elements can strengthen learners' perceived competence, invested effort, and value attributed to L2 learning tasks (Vandercruysse, Vandewaetere, Cornillie, & Clarebout, 2013). Loewen et al. (2019) reported similar findings on the basis of more anecdotal evidence. This highlights the need for further and more rigorous research examining the impact of extrinsic rewarding on intrinsic

motivation in gameful L2 tasks, especially in longitudinal studies, and with a special focus on whether and how this mediates actual L2 learning.

Recommendations for Practice

Current research offers no 'plug and play' solution for the effective implementation of games in L2 teaching. Despite the promise of educational L2 games, they are often limited in terms of curricular scope and applicability to the communicative classroom. It is also not straightforward to apply insights of SLA-focused research with off-the-shelf games to the design of game-informed L2 tasks. In order to effectively integrate games in the communicative classroom, teachers need to focus primarily on repurposing off-the-shelf games through pedagogical mediation (e.g. Mawer & Stanley, 2011; deHaan, 2019). This mediation can leverage affordances of games for L2 teaching on three levels: for generating abundant comprehensible input (games as content/linguistic resources), for stimulating communication in TBLT-inspired tasks (games as catalysts of communicative activity; see Table 2), and for valuing the linguistic and cultural capital that students develop when engaging with games and their communities (games as ecologies).

As for comprehensible input, considering the strong evidence that games are allies for the learning of vocabulary, in particular low-frequency vocabulary that cannot always be addressed in standardized curricula, games can be put to use for content-based learning. In essence, learning the language of a particular game or game genre is not all that different from learning the language of engineering or business. Gaming texts and ecologies have been found to comprise low-frequency lexical items as well as both simple and highly sophisticated syntactic constructions (Thorne et al., 2012). Therefore, they can serve as the perfect complement for classroom instruction that focuses on more general-purpose language, while

offering learners (in or outside of the classroom) additional opportunities to practice general-purpose linguistic registers and learn highly domain-specific vocabulary and constructions—with appropriate scaffolding—in their field of interest.

When students engage in vernacular L2 gaming, they develop linguistic and cultural capital that is a critical part of their identity as L2 learners. Blume (2019) shows that this capital is often devalued in institutionalized L2 learning contexts, as also happens with other forms of popular culture. This results in a new type of 'digital divide' that is based on the differing attitudes of learners and teachers towards the medium, rather than on access to games. Therefore, it is essential that discussion of the affordances and culture of games is included in the curriculum of language teacher training programmes.

Future Directions

Going forward, innovations can be expected on the level of technology, methodology, and theory. First, the emergence of new platforms for virtual and augmented reality will likely maintain and perhaps create novel interest in the field of gaming for L2 learning. It is critical that studies on these new technologies do not ignore current conceptual frameworks and empirical findings, but build on what has been established so far.

Secondly, on the methodological level, current research has relied to a great extent on self-report measures such as game journals, questionnaires, and interviews. While such instruments can provide rich data, it will likely become easier to obtain direct access to learners' gameplay experiences through log files (Cornillie et al., 2017; Loewen et al., 2019; Scholz & Schulze, 2017) and data of platforms for game streaming, as well as to eye-tracking and psychophysiological data captured with sensors embedded in virtual reality headsets and wearables. This can help to gather both more fine-grained and perhaps more objective data of

game-based learning processes in less intrusive ways, and in ecologically valid research settings.

Finally, as a relatively young but highly interdisciplinary field of research, it is essential that theory formation crystalizes. Insights from fields such as game studies and game design will hopefully help to disambiguate game elements and mechanics, so that SLA and CALL researchers can evaluate their impact on L2 development, and instructional technologists and teachers can effectively apply the insights of such empirical work to the design of gameful environments for instructed L2 learning.

NOTES

[i] Educational games are sometimes conflated with *serious games*, but the latter concept also encompasses games designed for non-educational objectives such as health management.

[ii] For this reason, and in accordance with a canonical term in the CALL literature, Cornillie et al. (2012) called these games 'tutorial games'.

[iii] In accordance with the wider educational technology literature, *(digital) game-based language learning* has also been used as an umbrella term to refer to the entire field of research on gaming environments for L2 learning (Cornillie et al., 2012; Hung et al., 2018; Reinders, 2017).

[iv] Text-based gaming spaces that involve multiplayer interaction are known as MOOs: Multi-User Dungeon Object Oriented; see https://en.wikipedia.org/wiki/MOO.

Further Reading

The first suggestion for further reading offers a general introduction into the topic of gameful L2 learning at book length. The other books and volumes approach gaming from the more specific perspectives of, respectively, L2 pedagogy, the instructional sciences, motivational psychology, and game studies.

Reinhardt, J. (2019). *Gameful Second and Foreign Language Teaching and Learning. Theory, Research, and Practice.* Cham: Palgrave Macmillan.

A must-read for both novice and seasoned researchers and practitioners in the field of digital gaming for language learning, this state-of-the-art monograph offers a comprehensive and theoretically substantiated, yet accessible demystification of games and play in relation to L2 research, pedagogy, and instructional design.

Sykes, J. M., & Reinhardt, J. (2013). *Language at Play: Digital Games in Second and Foreign Language Teaching and Learning.* New York: Pearson.

Drawing on theories of SLA and pedagogical frameworks, this book primarily intended for teachers offers practical strategies for implementing games in the L2 classroom through fictional pedagogical scenarios, questions for reflection, examples, and ideas for projects. Its chapters deal with learning tasks and goal orientation, interaction, feedback, context, and motivation.

Tobias, S., & Fletcher, J. D. (Eds.). (2011). *Computer Games and Instruction.* Charlotte: Information Age Publishing.

This edited volume for educational practitioners and researchers provides an overview of the value of games for learning, instruction and training, with contributions from well-established researchers in the learning sciences.

Rigby, C. S., & Ryan, R. M. (2011). *Glued to Games. How Video Games Draw Us In and Hold Us Spellbound.* Santa Barbara: Praeger.

This easily digestible book, co-written by one of the originators of Self-Determination Theory, analyses the motivational psychology of gaming by means of examples of popular game titles and player experiences, and through the lens of SDT.

Walz, S. P., & Deterding, S. (2014). *The Gameful World. Approaches, Issues, Applications.* Cambridge, MA: MIT Press.

The Gameful World is a landmark volume on the intermingling of games with everyday life through playful and persuasive design.

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