# Computer Games and Language Learning

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## Abstract

The chapter discusses and examines the educational potential of computer games in language learning. The commercial success of games has recently attracted the scholarly study from various fields. However little has been done in term of learning theories despite the increasing interest in educational games. Thus, in this chapter, theoretical issues and practical challenges in game-based language learning are raised to provide an overview on the potential of gaming technologies for such purposes. Some prominent learning theories in relation to computer aided language learning are detailed. This is followed by a discussion of what computer games are before some case studies of game-based language learning are presented. Some implications on the language uses of computer games are derived and discussed.

## Introduction

Despite the traditional belief that games, as opposed to work, are unproductive and non-utilitarian, some scholars have challenged this view and attempted to paint a different picture on this issue. Johan Huizinga (1944) for example maintained in his book Homo Ludens that the earliest stage of culture is in the form of play and that culture proceeds in the shape and the mood of play. He also claimed that some elements of play crystallise as knowledge such as folklore, poetry and philosophy as culture wears on.

A more contemporary play scholar, Chris Crawford (1982), in his seminal book 'The Art of Computer Game Design' scrutinised play within computer games and maintained in line with Huizinga that play is the sources of knowledge and that the most fundamental motivation of play is, in fact, to learn.

New technologies such as the computer have revolutionised the way games are played. Nowadays, computer games are being used for more than simply entertainment. Some even argue that it is time for games to deal with more serious matters. One of the oft-mentioned serious uses of games is educational games. Research in game-based learning emphasises the natural learning process that happens within the game and how this could inform the design of educational games developed explicitly to support the learning of a subject matter.

Some research has been conducted to investigate the potential of computer games in providing a language learning environment (Stubbs 2003; Rong & Topolewski 2002; Mich et. al 2004). Basically, the research of computer game based language learning

focuses on two perspectives: computer games as a virtual environment that supports language learning on its own and computer games as a tool or medium to facilitate collaborative learning.

The aim of this chapter is to provide an insight on both language learning theories as well as computer games, and how understanding these can help implementing games for language learning in a practical setting. The objectives are to:

- Highlight the pedagogical theories in term of language learning
- Discuss the relationship between computer games, language and learning
- Present some cases on game-based learning

## Language Learning

This section attempts to explicate how languages are learned by humans from different angles. Language learning is divided into several aspects: phonology, orthography, lexicon and semantics, morphology and syntax as suggested by linguists (Akmajian, et al. 1984). Often, we also include sociolinguistic and pragmatic aspects that deal with the contextual use of language in a real social cultural setting. Learning theories have had a significant impact on the development of language learning tools. Thus, three major pedagogical epistemologies, i.e. behaviourism, cognitive constructivism and social constructivism are expounded. Then the evolution of computer-aided language learning in light of these theories is discussed.

**Language and linguistic**

Before discussing language learning and theories, we would like to take a look at what constitute language. Psycholinguists break down a language into its five basic elements which are based on linguistic skills and they study how each element is comprehended, produced and acquired:

1.  Phonology describes the way sounds function within a given language.

2.  The orthography of a language is the set of rules of how to write correctly in the writing system of a language. In today's sense, this includes spelling and punctuation.

3.  A lexicon is a list of words together with additional word-specific information, i.e. a dictionary. It is the study of meaning of that term. Semantics is often opposed to syntax, in which case the former pertains to what something means while the latter pertains to the formal structure or patterns in which something is expressed.

4.  Morphology is a sub-discipline of linguistics that studies word structure.

5.  Syntax is the study of the rules, or "patterned relations", that govern the way the words in a sentence come together. It concerns how different words are combined into clauses, which, in turn, are combined into sentences.


Sociolinguists on the other hand maintain that learning language is about the social and pragmatic use and do not put much emphasis of each element of language. Pragmatics is generally the study of natural language understanding, and specifically the study of how context influences the interpretation of meanings. Context here must be interpreted as situation as it may include any imaginable extra-linguistic factor, including social, environmental, and psychological factors.

Sociolinguistics is also the study of the effect of any and all aspects of society, including cultural norms, expectations, and context, on the way language is used (Fasold 1990). It also involves the accent, dialect, politeness, social relation, folk wisdom (proverbs, legends) and register (style, or a marked ways of speaking). For sociolinguists, acquiring accurate and standard knowledge of each language element is not significant, what is more important is the communication skill in a society.

**Learning theories, languages and CALL**

In the past decade, the study of language learning has witnessed a paradigm shift. Many assumptions of behaviourist theories of learning have been challenged by a combination of more socially and constructively oriented theories (Hoven 1999, Warschauer 1996).

Behaviourist language learning

The rise of behaviourist epistemology in the early 20th century has had a remarkable impact on language learning. Behaviourist account of language acquisition stresses that utterances and speeches served as conditioned stimulus and conditioned response. Therefore associations and reinforcements are considered the primary factors in the acquisition of language. In language teaching, the behaviourist approach presents the learner with a series of habit-forming modes of learning (Hergenhahn and Olson 2001).

Most early implementations of computer-aided language learning (CALL) from 1960s to 1970 were greatly influenced by behaviourism. These CALL programs usually

consisted of grammar and vocabulary tutorials, repetitive language practices or the so-called drill-and-practice programs which strictly followed the computer-as-tutor model (Warschauer 1996; Warschauer & Healey 1998).

They were designed to provide immediate positive or negative feedback to the learner on the accuracy of their responses. The focus was on explicit grammar instruction and translations rather than practical usage.

While it has faced a great deal of opposition, reinforced habits are relevant for certain aspects of language learning. In our opinion, behaviourism is useful in explaining language learning from at least three aspects: phonology, orthography and lexicon. It should be understood that phonemic acquisition involves imitations and stimuli-response associations especially at the early stage of learning before the learner applies these phonetic rules to a semantic and contextual situation. Spontaneous responses are also very much desired to produce sounds when seeing the writing.

Like phonology, the behaviours representing orthography are transferred to the learners without involving much mental processing. The desired responses (producing or recognising written characters) are conditioned through behavioural learning. Learning lexicon could occur through behavioural learning by associating the world or reality with a set of words. However, as the learners advance to a higher level, they will realise that the sound of each phoneme varies in different words and that some words might carry different semantic meanings in different sentences and contexts. This is when behaviourist learning starts to break down as we are unable to associate

our acquired learning of sounds, writings and words to every possible new sentence we encounter, as virtually every sentence is novel.

## Constructivist Language Learning

In Piaget's cognitive constructivist view, intelligence consists of two processes, organisation and adaptation. People organise their thoughts so that they make sense and connect one idea to another (Boden 1979). At the same time, people adapt their thinking to include newly encountered ideas.

Cognitive psychologists emphasised the importance of meaning, knowing and understanding that construct internal representations. In the case of language acquisition, these representations are based on language systems and involve procedures for selecting appropriate vocabulary, grammatical rules, and pragmatic conventions governing language use (Kiymazarslan 2006).

In line with this cognitive constructivist views of learning, the second phase of CALL development emerged in the late 1970s and early 1980s. It is stressed that CALL should focus more on using languages rather than on the languages per se.

As such, communicative approaches to language learning manifested themselves in this stage. It stressed that computer-based learning should focus more on using forms than on the forms themselves and encourage students to generate original utterances rather than just manipulate prefabricated language.

Cognitive constructivism explains some aspects of language learning which cannot be explained by behaviourism in a conducive way. Although it is true that vocabulary could be transmitted to the learner, the meaning of each word (semantics) might need to be constructed and mapped to the learner's mental scheme which is continuously being organised, modified and updated, when using words in different contexts. The use of a word in a novel situation which is never been taught to the learner before is something that cannot be accounted by behaviourism. In addition, it doesn't sound reasonable to attribute the production of sentences and word structure formations to imitation or conditioned responses. Learners learn to produce sentences they have never heard before based on a set of morphological and syntactic rules internalised by them through cognitive constructivism. The rules for sentence formation require mental processing, and are inferred through hypothesis testing and active mental construction.

Vygotsky (1930) shared many of Piaget's assumptions about how people learn, but he placed more emphasis on the social context of learning. He believed everything is learned on two levels. First, through interaction with others, and then integrated into the individual's mental map. Therefore, he believed that social interaction plays a fundamental role in cognitive development.

For Vygotsky the social cultural environment gives people the cognitive tools needed for learning. The kind of cultural tools include cultural history, social context, and language used by the learner. The emphasis on social constructivism tends to move from learners' interaction with computers to interaction with other humans via the

computer. This brings CALL development to another phase, which stresses meaningful interaction in authentic discourses.

This stage of CALL is said to have started in the late 1980s and early 1990s. This approach attempts to integrate learners in authentic environments in which computers are no longer seen as tools that could be interacted with to acquire language skills. Instead computers are artefacts that could mediate human interaction.

While cognitive constructivism explains how learners acquire linguistic skills, it does not consider how learners, equipped with these skills, use them socially and pragmatically. Social constructivists' emphasis on social interaction and it is useful for understanding of the acquisition of sociolinguistic and pragmatic language competences, in which these skills are learned through interaction, communication and assimilation of others' speech.

## Computer Games

Many have proposed several different definitions of games. For this chapter, we would like to use Juul's definition. His definition of game is stated as follow:

"A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable." (Juul, 2003)

The game definition he proposes contains six parameters:

1. Rules: Games are rule-based.

2. Outcome: Games have variable, quantifiable outcomes.

3. Value: That the different potential outcomes of the game are assigned different values, some being positive, some being negative.

4. Effort: That the player invests effort in order to influence the outcome.

5. Player's attachment: That the players are attached to the outcomes of the game in the sense that a player will be the winner and "happy" if a positive outcome happens, and loser and "unhappy" if a negative outcome happens

6. Negotiable consequences: The same game can be played with or without real-life consequences.

### Narratives and computer games

Although it is generally agreed that computer games are not narratives, some scholars treat computer games as a highly potential medium for storytelling. Murray (1997) for example explores the storytelling computers offer and states that computers could be interactive narratives. She accounts three perspectives on the aesthetics of interactive narrative: immersion, agency and transformation. According to Murray, the computer is providing us with a new stage for the creation of participatory theatre. We are gradually learning to do what actors do, to enact emotionally authentic experiences that we know are not real. In a game environment, the "reader" is able to take meaningful actions and see the result of his decisions instead of being a passive reader. This power of interaction is described as agency. Besides, interactive narratives offer the opportunity for the reader to not only witness stories but to enact them. It means an experience wherein readers are invited to enact or construct their own stories out of

a set of formulaic elements. The enactment is transformative as the readers assimilate their actions on the virtual world as personal experiences.

### *Simulations and computer games*

Instead of studying computer games as narratives – the dominance of game study for decades – others opt for the study of computer games as simulations. Both narratives and simulations are media that represent reality although with different approaches. Unlike traditional media such as texts, pictures or videos, simulations do not simply represent but they also model a system (Frasca, 2001). A picture of a car conveys the meaning and the idea of a real car to the viewer by depicting the characteristics of the car: colour, shape, size, etc at a particular frame of time. A video about a car of course reveals more about the car than a picture does, as it shows the changes of the car with time. A toy car shows the players more than these; it models the behaviour of a real car: how the wheels spin and how the car moves. By watching the video, one can infer the rules of a car, while the rules are dynamically applied on the toy car for the players to experiment and test. Basically, the representation of narratives is bottom-up, as they describe the events from which we can generalise and infer rules. Simulations are usually top-down: they focus on general rules, which then we can apply to particular cases.

## Case Studies

Some research has been conducted to investigate the potential of computer games in providing a language learning environment. Basically, the research of computer game based language learning focuses on two perspective: computer games as a virtual

environment that supports language learning on its own (player-game interaction), as well as computer games as a tool or medium to facilitate collaborative learning (player-player interaction).

**Player-game language learning system**

The focus of the research under this category is on understanding the possibility of language learning within a computer game, and the researchers aim to design a better game for teaching languages. Some research attempts to analyse the vocabulary learning in existing educational games, while some propose alternative design of CALL based on interactive participatory dramas and virtual environment.

Kana no senshi: study of HCI design for language learning software based on first person shooter game interface

"Kana no senshi" is a computer game which is harnessing the player-game interaction for Japanese language learning (Stubbs 2003). In this project, the researcher is interested in designing a CALL application based on the user interface of a typing game, 'The Typing of the Dead', which is an extension of the 'House of the Dead', a first person shooter (FPS). In the typing tutor, the player must kill zombies by typing English phrases displayed next to them before the zombies reach and kill the player. In "Kana no senshi" each zombie is associated with a Japanese character, either hiragana or katakana (Figure 1).
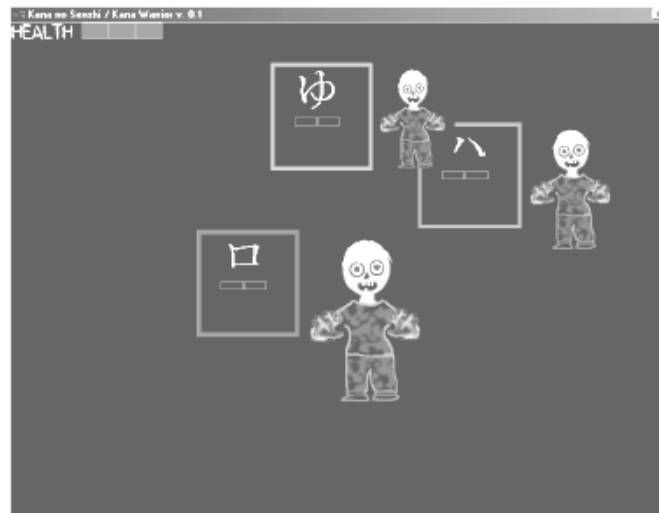
Figure 1. The user interface of "Kana no senshi"

A pilot study is also conducted by comparing "Kana no senshi" to a traditional interface and it is found out that the participant using the game-based interface show a few significant differences in their performances.

In fact, there has been a rise of interest on computer game interfaces in the human computer interaction (HCI) community. Researchers are eager to understand what makes a game so appealing compared to other software applications. The use of game interfaces in designing CALL has several advantages. First, it challenges the learner to read Japanese characters quickly. Second, it provides clear feedback to the learner if he or she has answered it correctly.

PARLING: e-Literature for Supporting Children Learning English as a Second Language

In another project, a multimedia system, named PARLING is designed to teach English as a second language among 8-11 year-old primary school children (Mich et. al 2004).

The idea behind the system is that famous children's literature offers the right motivating and low-anxiety context where users can improve their vocabulary and learn new language structures. The system implements a speech recogniser that allows implementing automatic pronunciation assessment. The children will read the story and understand the vocabulary. The system will also read out the story and there is a pictorial dictionary for certain words in the story. They can also choose to play a game which will help them memorise the vocabulary (Figure 2).

A preliminary usability test of the prototype system gave positive results. Children were observed to show positive attitude towards the system.



Figure 2. A screenshot of PARLING

Tactical language training system

Perhaps the most ambitious attempt to utilise player-game systems in language learning is the use of artificial intelligence (AI) to create intelligent agents in the game that could hopefully communicate with the players in a realistic way (Johnson 2004). Tactical language training system is developed to help training US military personnel to communicate in Levantine Arabic. The system implements a real time 3D game engine and natural language processing technique. The training focuses on spoken Arabic, non-verbal communication as well as the culture. The program uses intelligent non-player character, which is controlled with the game AI based on a program called PsychSim and a pedagogy agent who will leads the player through the game. Apart from these, the game takes place in a simulated virtual Arabic village (figure 3), where the player needs to communicate with the villagers to find out information useful for the mission.
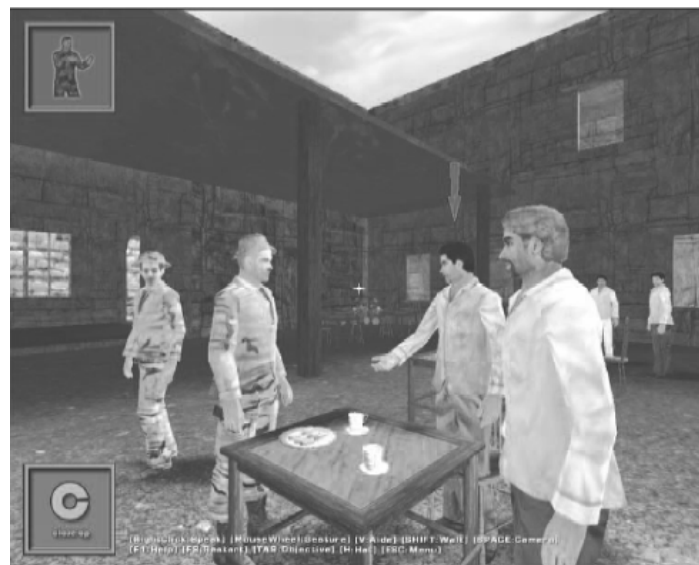


(a) The game mode

(b) The tutorial mode

Figure 3. Tactical language training system

## Player-player language learning system

Recently, with the emergence of massively multiplayer online games (MMOGs), some scholars have begun to study the potential of these player-player systems, which includes the broader social context of game play.

There is an interest in studying MMOGs but not much has been devoted to language learning. Perhaps the more common research on player-player game systems for language learning revolves around MOO, the antecedent of MMOGs. MOOs (Multi-user, Object-Oriented) are text-based virtual realities which are housed on computers connected to the Internet. They serve various functions, e.g., social, educational, and play (games). Many of the socially oriented MOOs give people a safe environment in which to meet and talk to people from all over the world (Turkle 1995).

## MOO and game-like language learning activities

In this case, the focus is on the various playful uses of language that occur during a semester-long study of two German language courses using MOO (Warner 2004).

The analysis reveals that a large portion of the language used online cannot be described using standard referential definitions of communication, but rather is playful in nature. Using research from second language acquisition and theories on social interaction, this case investigates the different types of play that occurred within the online discussions and the possible implications of the presence of play in online discourse

It attempts to study different types of language play that arise, as well as the contribution of this play to foreign language acquisition when using MOO for learning German.

The study identifies three forms of language play:

1. Play with the Form. In this first category are those types of play that focus primarily on the form, rather than the meaning of the language.

2. Play with the Content/Concept. Focus on the meaning of the language

3. Play with the Frame. Play with the frame is largely meta-linguistic and occurs on the level of understanding.

It shows that these forms of language play, which have been underemphasised in foreign language pedagogy do exist in MOO. Play should be acknowledged as a

legitimate use of language and attention should be paid to game-like playful elements in language use when it comes to language learning.

The following table (Table 1) shows a summary of the case studies presented in this section:

Table 1. The summary of computer-game-based language learning

| Game/project | Theoretical foundation | Language aspects | Research focus |
|---|---|---|---|
| Kana no senshi | Behaviourism | Phonology, Orthography | HCI, motivational factor |
| Parling | Behaviourism, cognitive constructivism | Lexicon, syntax | HCI, motivational factor, narratives, speech recognition |
| Arabic (the game) | Cognitive constructivism | Sociolinguistic, pragmatic | Simulation, AI, speech recognition, NLP (natural language processing) |
| MOO | Social constructivism | Sociolinguistic, pragmatic | Social interaction, collaboration |

## Games and Language Uses

The emergence of language-based interaction in computer games signifies the need of adequate linguistic and sociolinguistic competences in successful game play. In this section, we review the use of language in computer games and how these games might be useful for language learning.

## Player-game verbal interaction

Early graphic games with abstract representation of the world hardly use language at all. A player is able to play and master the game with minimum or no linguistic competence. The first game, Spacewar (1978) does not use any verbal language and the game does not depict a rich world or tell a story. Throughout four decades of computer game development, people are eager to use computer games to tell a story that takes place in a virtual world. The first attempt is to use textual language, and the text-based adventure is created. In a text-based adventure, the entire world and the player actions are described with texts ("You are standing next to a white house. There is a mailbox").

The increasing capability of graphic processing encourages the creation of a game with a more detailed world, a world closer to reality. As languages are pervasive in the real world, the virtual world is full of the use of language as well. A more visually believable world intrigues the interests of game designers to tell stories in their games. Adopting the classic media, game designers start to use languages occasionally to explain the progress of the game story which is usually not significant to game playing.

In order to project more believing game characters, they start to "talk". This is when the playing of computer games is again related to linguistic skills. Like a text-based adventure game, without understanding the language, the players can hardly proceed in the game. Apart from these, the story scenarios are sometimes told in the form of textual languages by a narrator. The players must understand some of these narrations in order to know the goal of the game. It is basically impossible to play the game without knowing the dialogue.

As David Bordwell (1985) has noted, classical film is goal-oriented. It defines a central objective for the protagonist to achieve, and it makes the protagonist's progress difficult by setting up a series of obstacles to overcome. The structure of most computer games fits this paradigm quite precisely. But the different structures of the two media affect the way dialogue points us toward the goal.

Smith (2002) explains in full length how languages play an important role as the game dialogue by analysing narrative games. He articulates that like other media, a young medium such as computer games borrows and inherits expressive forms from older media, and transform them along the way.

His analysis shows that game dialogues are used to enhance the player's understanding of the overall plot. Textual dialogues slowly expose the past bit by bit; while the game play pushes us forward to a higher level, the dialogue gives us an increasing sense of what has occurred before we arrive in this world. Apart from

presenting sub-goals for game progress, dialogues also let us understand more about the world and the character.

As the processing power of computers continues to grow, the use of speech languages, usually accompanied by textual languages as subtitles are becoming common. This is then followed by the use of video and animations that includes textual and speech languages, as well as non verbal languages. A game is now pervaded with the use of languages in every bit of it. Table 2 presents a brief summary of player-game verbal interactions.

Table 2. A brief summary of player-game verbal interactions

| Physical player-game verbal interaction | The interaction between players and the text of the game manual, etc |
|---|---|
| Virtual player-game verbal interaction | Usually refer to the information retrieval by interacting with the non-player character (NCP) or game interfaces. In some cases, the player might also provide verbal input either by choosing a given textual option, typing texts or even through voice input. |
| Game-to-player (Output) | Command, interface, story presentation, instruction, goal introduction, dialogue with NPC, narrator's voices |
| Player-to-game (input) | Key in protagonist's name, choose dialogue options, key in commands |

## Player-player verbal interaction

The language communication between players and games are very limited to those pre-fabricated by the game designer. Non-layer characters' (NPCs) discourses are so limited that they keep breaking the immersion: players are continually reminded that they are dealing with a computer agent. Apart from these, some players do not bother to read the narrative text on screen, as they are more concerned on game playing.

The latest incarnation of computer games, massively multiplayer online games (MMOGs), suggests another way of language use in games. The designers no longer script all the languages in the game, as they used to do when all the characters, except for the player, were NPC. These MMOG games actually encourage social interaction by enacting stories through collaborative tasks as well as chatting.

We can see the shift of language use from language perception, to language production in computer games, although language perception remains important. The players are invited to construct sentences which are related to the virtual social setting in the game. Team-based gaming encourages coordinated actions even in situations where there is no appointed leader. Negotiation of artefacts (buying, selling, exchanging) become an important part of role playing games (RPGs).

In MMOGs, the player groups usually utilise some amount of communicative action in order to collaborate in certain tasks. Most of the negotiations during consensus-seeking are executed through language-based communication, thus, making language the main tool for this action.

Wright (2002) studies the social interaction in Counter Strike (1999) and proposes a typology of game talk. He identified five talk categories in the game:

1. Creative Game Talk: involve talks related to the creative play in the game apart from adhering to the formal game rules.

2. Game Conflict Talk: include cheating, banning of the players and rules talk, talks to mediate conflicts or to invoke conflicts

3. Insult/Distancing Talk: Taunting talk/trash talk/ritual insults, annoyance talk

4. Performance Talk: Talk about performing in the game, how to play better, helping others, strategy, mission, failure, victory

5. Game Technical/External Talk: Lag, scheduling, other games, lag; talk about technical matters and other game/computer related matters

Tosca (2002) also found out that the speech community in MMOGs goes beyond linguistic aspects and dwells into sociolinguistic and pragmatic uses of language. She analyses the Everquest (1999) from a pragmatic point of view, in order to find out how this community could be characterised. Using the discourse analysis technique, she argues that this kind of game could be considered a speech community. Although it is possible to play Everquest without engaging in conversation at all, players do constantly interact verbally with each others. Table 3 presents a brief summary of player-player verbal interactions.

Table 3. A brief summary of player-player verbal interactions

| Physical player-player verbal interaction | articulate language or even written language (drawing a map to share with other players) when the game is |
|---|---|

| | |
|---|---|
| | going on (for players who play a game in the same physical location) |
| Virtual player-player verbal interaction | mostly the game chatting system, or any other writing functions |

## Summary

This chapter has presented an overview of game-based language learning through various points of view including both theoretical and practical issues. As learning theories continue to progress, more innovative CALL technologies will be developed to enhance language learning. We believe that computer games might provide some solutions to certain aspects of language learning especially in generating motivation and pleasure in the learners. Based on the current stage of research, most effort in game-based language learning is still emphasised on the player-game interaction in which computer games are loaded with learning materials for learners to "discover". In future however it is hoped that more games will be designed as a virtual learning environment in which learners congregate and engage in linguistic communication, learned from each other in a social context.

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book ' User-Centred Computer Aided Language Learning'.

## Key term

**Computer games**

A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable.

**Language learning**

Process of learning language, including learning foreign languages; language development.

**Learning theories**

Theories such as behaviourism and constructivism that attempt to explain how learning occurs in learners.

**CALL**

Computer-aided language learning.

**Narratives**

The telling of the story.

**Simulation**

A system that creates the experience of a real situation.

**Player-game interaction**

The interaction between the player and the game through input and output devices

**Player-player interaction**

The social interaction between players, including verbal interaction and non-verbal

interaction.