

# Modeling Language Acquisition in Commercial Off-the-Shelf Games: A Multiple Case Study

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**Abstract:** Recent years have seen an increase of game-based approaches to a variety of learning contexts, including language acquisition. However, scoping literature reviews on existing games have revealed that while the learning approaches are carefully considered when creating educational games, many such games lack fundamental design elements. In this regard, educational games can learn from commercial, entertainment-oriented video games, where careful game design and maximizing player engagement are key considerations. Although niche, there is a genre of games where the core gameplay loop involves the player deciphering a language. This paper applies close reading techniques to commercial games that have learning artificial languages as their core mechanics, exploring the game design techniques those games use to foster and encourage language learning. In particular, this paper focuses on how commercial games leverage their unique characteristics, such as the ability to immerse the player in the context of the language they are learning and provide direct and indirect feedback tailored to the player's actions. This will be accomplished by analyzing the learning process through the lens of Second Language Acquisition (SLA) theory. The two games chosen for analysis are *Heaven's Vault*, one of the first games to have language interpretation as the main game mechanics and *Chants of Sennaar*, arguably the most successful commercial game based on language learning. By analyzing the games, this paper aims to chart how different commercial games facilitate language learning, and offer ideas on how those design elements can be implemented in educational games.

**Keywords:** Game-Based learning, Language learning, Close reading, Game design, Vocabulary

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## 1. Introduction

In recent years, the use of video games in educational contexts has risen significantly, leading the practice to be recognized as a field of study and given the name game-based learning (GBL) (Hung et al., 2018). GBL has been applied to a wide range of subject areas, including mathematics (Kebritchi et al., 2010), programming (Videnovik et al., 2023), and language learning (Xu et al., 2019). Among those, language learning is considered a field particularly fit for the application of GBL, because of how game affordances enable language acquisition (Reinhardt and Thorne, 2020).

Despite the large amount of research conducted on the topic, scoping literature reviews on existing language learning games have revealed that, while the learning approaches are carefully considered when creating educational games, many such games lack fundamental design elements (Xu et al., 2019). In this regard, educational games can learn from commercial, entertainment-oriented video games, where careful game design and maximizing player engagement are key considerations.

Although niche, there is a genre of games where the core gameplay loop involves the player deciphering a language. In these games the player's goal is to use environmental clues and previously deciphered words to connect signs to their meaning, and then leverage their understanding of the language to solve puzzles and progress in the game.

This paper applies close reading techniques and hermeneutic inquiry to commercial games that have learning fictional languages as their core mechanics, exploring the game design techniques those games use to foster and encourage language learning. Fictional languages have been defined as a subset of artificial languages that are primarily meant to create the fictional world they are a part of (Barnes & van Heerden, 2006).

The reason for choosing games that teach fictional languages rather than natural ones is that those games do not focus on any particular feature of a given language, and the way they model language learning can be abstracted to a more general, non language-specific set of observations.

In particular, this paper focuses on how commercial games leverage their unique characteristics, such as the ability to immerse the player in the context of the language they are learning and creating a space for the player to fail without consequence and receive feedback. This will be accomplished by performing a close reading of the game mechanics fostering language learning, through the lens of Second Language Acquisition (SLA) theory. The two games chosen for analysis are *Heaven's Vault*, and *Chants of Sennaar*.

By analyzing the games, this paper aims to chart how different commercial games facilitate language learning and to offer ideas on how those design elements can be implemented in educational games.

## 2. Background

The theoretical background for this analysis is based primarily on two fields: Game-Based Learning (GBL) and Second Language Acquisition Theory (SLA).

GBL has been defined as “a playful activity that is structured by rules for the pursuit of quantifiable outcomes (e.g., win states and points), and incorporates educational objectives (e.g., knowledge acquisition) as its own end” (Hung *et. al.*, 2018 p. 1), or, more simply, as the use of “games with specific learning goals” (Plass *et. al.*, 2020)

GBL focuses on leveraging games to teach, either by themselves or as support to other modes of instruction. It differs from gamification or playful learning, which apply some game elements to non game-tasks, because it leverages all features of games, and implies a complete redesign of the learning activity into a game (Plass *et.al.*, 2020).

While serious games, games designed and primarily used for educational purposes (Crookall 2011, Ritterferd, 2009), constitute an important section of game-based learning, there have also been studies focused on how learning can occur in commercial games (Aleksić *et. al.* 2016) and how they implement learning principles (Beckett 2008). Gee (2003) highlighted how games create learning, among other ways, by having a mix of explicit instructions and free exploration, helping the player perform an identity, and providing an environment for practice and immediate feedback. Identity performance is an aspect of game-based learning particularly relevant to this analysis, as it has been found to be an important factor in language learning in game (Reinhardt and Thorne 2020). Gee (2003) identified three main identities at play in a video game: a virtual identity, a real world identity and a projective identity. Virtual and real world identity refer respectively to the identity of the game character and of the player playing the game. Projective identity, on the other hand, indicates both how the player projects their values and ideas on the virtual character and how the character is a project the player has.

Second Language Acquisition theory is concerned with the acquisition of non-native languages, and how people created new language systems with only limited exposure (Gass *et.al.*, 2020). The input hypothesis of second language acquisition posits that language is acquired by decoding inputs, and that learners advance their knowledge by decoding sentences slightly above their current level (Krashen 2003). According to this theory, explicit grammar teaching and output production can contribute to learning, but not to acquisition (Krashen 2003).

A subset of SLA theory particularly relevant to this analysis is Vocabulary Acquisition. According to Nation (2001), there are three main steps that lead to a word being remembered: noticing, retrieval and generative use. Noticing occurs when the learner pays attention to an item, and motivation and interest are important enabling conditions. The noticing process can also be triggered by negotiating the meaning of the word when it is encountered. Retrieval happens on any new encounter with an already noticed word, and it strengthens the memory of that word. Finally, generative processing occurs when previously learned words are met or used in ways that are different from previous encounters, and like retrieval can be receptive or productive. Generative processing is particularly helpful for learning, as there is “low correlation between total exposure to the word and learning, but high correlation between learning and the number of uses of the words not closely dependent on input” (Nation, 2001, p.107).

The potential for games to be used as a vehicle for language learning has attracted much attention from researchers, with a scoping literature review from 2019 finding 59 papers evaluating games to teach English (Xu *et. al.*, 2019). Reinhardt and Thorne (2020) identify eight game-based L2 learning affordances. Out of those eight, four are particularly relevant to this analysis: Contextualization and linguistic environment, which leverage a game’s ability to contextualize game mechanics in a coherent narrative, helping the player associate form, meaning and function through interaction with the game world; Games as a shelter for practice, that push learners to take more risks and practice freely; Goal orientation, purpose and feedback, which makes use of the goal-directed nature and feedback mechanisms designed into games to direct and provide timely feedback to the learner; and finally identity performance, which leverages the process of identity construction typical of games with a single protagonist to push the learner to perform an identity that will help with L2 learning.

## 3. Methodology

The methodology at the core of this analysis is hermeneutic inquiry, particularly in the form of close reading.

Hermeneutic inquiry is an epistemological tradition “grounded in the expert interpretation of texts from a given point of view” (Tannenbaum, 2015). In hermeneutic inquiry, knowledge does not come from an objective measuring of reality, but rather from the equilibrium between the demands of a text and the reader’s situated subjectivity that emerges from reading (Føllesdal, 2001). Using close reading as the main analytical tool allows for a closer look at the specific implementation of the mechanics, considering them in the broader game context and analyzing the details of how they are created and used to foster learning.

Close reading is a hermeneutic technique developed in the context of literary theory, and consists of “a detailed examination, deconstruction, and analysis of a media text” (Bizocchi and Tannebaum, 2011). It can be used to look at the poetics of a text, meaning the mechanisms that a work uses to achieve an aesthetic effect (Tannenbaum, 2015). Close reading with a focus on poetics is oriented toward empirical and observable elements of a text, and as a consequence is closer to a form of objectivity compared to other lenses that can be applied to a close reading approach (Tannenbaum, 2015).

Although close reading is a general approach suited for a variety of disciplines and contexts, it does not always take the same form. There are unique challenges and aspects to consider when applying a close reading approach to video games, and ad hoc guides have been created to help apply hermeneutic interpretation to video games (Kłosiński, 2022).

Tannenbaum (2015) identifies four main challenges in close reading video games compared to other kinds of texts: indeterminacy, scope, difficulty, and random access. Since this analysis is primarily focused on the mechanics of the games, difficulty is the most relevant. Players of different skill levels can experience the same game differently: it is not just that unskilled players take longer to complete the game, rather, there are fundamental differences in how the players engage with the game. A player struggling with the controls will pay less attention to the aesthetic aspects of the game, and a player in a state of flow, immersed in the interplay of challenge and success (Csikszentmihalyi, 1990), will enjoy the game differently from a player for whom most mechanical challenges are trivial.

One way to address this difficulty is to approach the game from the perspective of a naive interactor, a player who has no previous knowledge and is playing the game for the first time (Tannenbaum 2015). While it is impossible to escape the scholar’s subjectivity, the imagined naive interactor provides a lens to attempt to set aside the previous knowledge and experience. The theoretical construct of the naive interactor is particularly relevant when analyzing mechanics, and is similar to the concept of “new player experience” (Bycer, 2020), a game design concept used to indicate how a player new either to the game, the genre or video games in general will experience the game. Since in both games analyzed in this paper the progression is knowledge-based, employing the perspective of a naive interactor is fundamental to understanding how the language learning mechanics work.

Another solution to address common issues in the close reading of games is using analytical lenses to focus the close reading. Analytical lenses are “artificial frames that a scholar can apply to a game in order to direct his or her attention to specific phenomena, while filtering out elements of the game that are less relevant” (Tannenbaum 2015). As gameplay often provides too much information to analyze all of it in depth, analytical lenses act as a filter to focus the analysis on specific aspects. In line with the focus of this paper, the lenses applied for the analysis are “language learning mechanics” and “vocabulary progression”.

The data collection method followed a mixed approach, aiming to capture both more immediate reactions to and reflections on the game, while using screenshots and recordings to ground my observations in the available data. It is inspired by the methodologies used by Tannenbaum (2015) and Kłosiński (2022) in their analyses. During play, I spoke my thoughts aloud and recorded them, while taking screenshots at both regular intervals and when any relevant puzzle or interface appeared on the screen. After each puzzle or game area I took a break to reflect on the experience and note down my thoughts on it, then wrote down a reflection and summary at the end of each play section. Finally, I returned to the notes the day after to perform a second analysis.

## 4. Analysis

### 4.1 Heaven’s Vault

*Heaven’s Vault* (2019) is an adventure game developed by Inkle, where the player takes on the role of an archeologist, uncovering the lost history of a space nebula in a sci-fi setting. The game is composed of two main modes: exploration, where the player roams around the nebula speaking to characters and collecting information, and the language puzzles. The language puzzles happen through the translation system that the

player can use to make sense of the ancient writings. For each word in the sentence the player is trying to translate, the game will offer three or more possible meanings, and show words related to the one on screen that the player has encountered previously (Figure 1).



**Figure 1: The translation interface in *Heaven's Vault* (2019)**

The game supports language learning in two main ways: the first one is having puzzles and a fictional language designed to encourage and reward vocabulary acquisition, and the second one is using the narrative and art to encourage identity performance and contextualize the learning.

The language puzzles are designed deliberately to encourage the player to examine each word closely, leading them to learn the language organically as they progress. The player does not have access to a glossary besides the one they build themselves by interacting with the game world, and receive no feedback on whether a word was translated correctly until they use it correctly a few times. Furthermore, while the language puzzles shine a light on the plot of the game and the history of the game world, they do not affect the exploration phase of the game in any way. As a consequence, the player cannot test their theories directly, but rather has to compare their translation of a word against other fragments and their context. For example, early in the game I read an inscription on a statue. One of the words of the inscription was *goddess*, which I had already translated, but the other one was unknown. However, the same word is also present on a well nearby, which made me infer the meaning of the word was *water*. This interpretation was reinforced when I saw the same symbol next to a riverbed later in the game, and the game confirmed that my translation was correct.

In terms of SLA theory, the game is teaching the language to the player by focusing on the first two phases of vocabulary acquisition: noticing and retrieval (Nation, 2001). Each word is highlighted separately when discovered, and the player has to input a guess for each word in the inscription to continue. The process used the most is negotiation (Nation, 2001), as the player is incentivized to not only make a guess in the moment, but return to older translations to refine them based on new information they find. Retrieval is created by having already translated words appear in new contexts and with the “related words” feature (see Figure 1). The design feature that enhances the role of negotiation and retrieval, and makes it possible for the player to learn the hundreds of words in the game in less than 40 hours, is the structure of the fictional language. Ancient, the language in the game, is an ideographic language that creates words by combining symbols. While the symbols are unique to Ancient and bear no resemblance to existing languages, the grammar is the same as English, with the same sentence structure and rules, to isolate vocabulary as the element the player has to figure out. The meaning of the single symbol is never explicitly given by the game, but the player, guided by the related words, will be able to infer it and use it to make sense of new words. Understanding the semantic field certain symbols refer to makes it easier to pick the correct translation, or even translate without any help: *palace*, for example, is made from “place” + “of” + “emperor”.

The artistic and narrative compartments of the game also play a role in the learning, by encouraging identity construction and contextualizing the language fragments the player is trying to translate. The protagonist is an

archaeologist, and the player is pushed to identify with her and her research, as the plot revolves around discovering the history of the nebula the game takes place in. The mechanics also contribute to the creation of a virtual identity of the player as an archeologist, as the knowledge the character and the player have of Ancient advances at the same pace. As the player becomes able to translate more and more complex sentences the projected identity the game pushes for (the best archeologist in the nebula) becomes a source of self-efficacy, a key element for learning and motivation (Jackson 2002). The game also provides a space to the player to perform a certain identity by providing agency in the exploration phase: the player can choose which areas to explore, the dialogue options, and what to do with the artefacts they find among other things.

*Heaven's Vault*, then, implements language learning as a core mechanic by relying on two interrelated aspects: the language puzzles and the narrative. The language puzzles focus on teaching the player the vocabulary of a fictional language, while the narrative contextualizes the player's findings, provides motivation for the player's actions and fleshes out the identity the player performs while playing the game. While the narrative and language puzzles are not directly in contact, they are still connected: the exploration is guided by translating fragments, and in turn contextualizes them.

#### 4.2 Chants of Sennaar

*Chants of Sennaar* (2023) is an adventure game developed by Rundisc. In it, the player takes the role of a cloaked figure traversing a tower inhabited by various tribes, each with its unique language. Except for some user interface elements, all writing in the game is in these fictional languages, and the player has to translate them to solve puzzles and progress the plot. To keep track of known words and input guesses, the player has access to a journal where they can write down the meaning they think a symbol has and associate symbols to images. However, the guesses are not confirmed until the whole page is filled correctly.

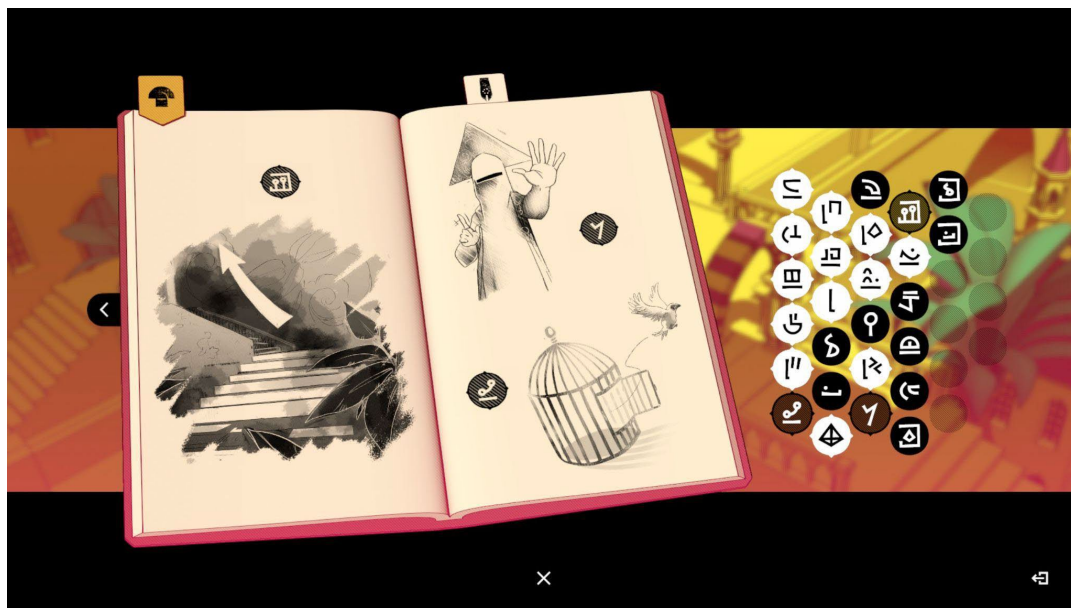


Figure 2: The journal in *Chants of Sennaar*

The main way *Chants of Sennaar* fosters language learning is by integrating it closely with the puzzle solving, using gameplay sections to help the player negotiate the meaning of the words and test their interpretation. Puzzles and environmental clues are the primary way for the player to test their theories, and the journal is more a quality of life feature to confirm guesses the player is almost completely certain of, rather than a consistent source of feedback. Integrating the language learning into the puzzles also helps achieve a pace of challenge optimal for learning: a game with a good difficulty curve presents a challenge that is slightly too difficult for the current skill level of the player, but possible to overcome with some practice (Cowley et. al. 2008). In the context of learning, a challenge slightly above the student's ability but within reach is called the "zone of proximal development" (Vygotsky, 1978), and is considered the optimal level of challenge to foster learning (Wass & Golding, 2014).

This pattern of gathering contextual clues from the world and refining guesses as the game progresses is present from the start: the first obstacle the player finds is a closed gate with a lever next to it, and a sign explaining the mechanism (Figure 3).

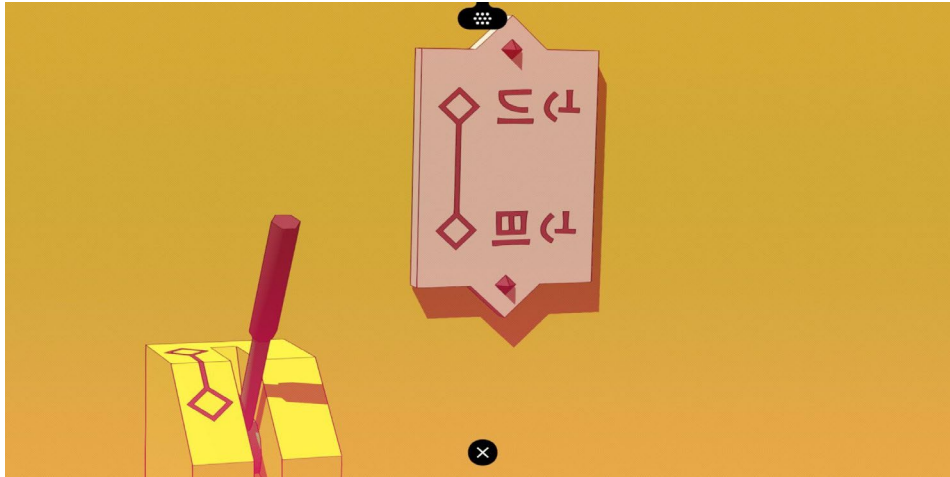


Figure 3: The first puzzle in *Chants of Sennaar*

When I first encountered the puzzle, I noted down two possible interpretations: either *open door/close door* or *lever up/lever down*. However, shortly afterwards a non-player character (npc) pointed at a closed gate, saying (in a speech bubble) the signs for *open door* (or *lever up*). As the position of the lever was not a factor in the puzzle, I refined the translation of the signs to mean “open gate” and inserted them in the journal, filling the page and receiving confirmation that my interpretation was correct.

Exploring the environment also provides information that can be used to translate new words or make inferences about the grammar of the language we are translating. Seeing the symbol for *person* repeated twice on a mural representing a crowd, for example, was key to understanding that the language uses radical-based repetition for plurality.

The languages in *Chants of Sennaar* are much simpler than Ancient in terms of their vocabulary, with each one consisting of around 40 words. However, they all have unique grammar rules the player has to figure out. Since the player relies so heavily on environmental clues for translating, the exploration of the internal logic of the various languages is almost absent: each word is represented by one symbol, with no clear similarity between symbols of the same semantic field, with a few exceptions, such as all words for places in the devotee language having a common symbol.

While the game relies heavily on having the player notice the words and negotiate their meaning, the phases of retrieval and generative use, important for long-term vocabulary learning (Nation 2001), are almost completely absent. This is mainly an effect of having the journal as a central mechanic, and how it is implemented. Once a player fills a journal page correctly, the words are given their intended meaning in English and from that point on will display that word when the symbol is hovered (Figure 4).



Figure 4: Automatic translation in *Chants of Sennaar*

The game assigning a definitive translation to the word interrupts the negotiation process the player was performing, and having the translation appear automatically makes it unnecessary for the player to retrieve the meaning of a word once it has been translated correctly once. Furthermore, the way the language is constructed makes it useless for the player to return to an already translated word in search of its etymology the same way they might do in *Heaven's Vault*.

*Chants of Sennaar*, then, relies mostly on integrating the language into its puzzles to both motivate the player and give feedback. Having almost no text in English makes it impossible for the game to have the same narrative and character depth as other adventure games, such as *Heaven's Vault*. However, in exchange the player is completely immersed in the language they are trying to learn, and every interaction is a source of new information.

## 5. Discussion

The games analyzed have language learning as their central mechanic. However, they are still commercial games and do not aim for the player to acquire the language to use it long-term or outside the context of the game. This section discusses how different design elements from the games analyzed could be adapted to be used in a game-based learning approach to language teaching.

One element that emerged from the analysis is that the games mostly help the player indirectly in their decoding work, only providing delayed feedback by confirming correct translations under specific circumstances. This choice, consistent with the input hypothesis (Krashen, 2003), also stops the player from “brute forcing” solutions and enhances the sense of mystery the player experiences from being dropped in an unknown context. This also shows that the aesthetics of the game, sometimes left to the sidelines in learning games, can affect the motivation and learning outcomes as much as the design and instructional theories.

The noticing stage of vocabulary acquisition is present in both games, with both relying heavily on negotiation to make sure the player engages with the words carefully and explores how they are used in different contexts. On the other hand, retrieval is much less prominent and generation is completely absent. The lack of retrieval comes from the automatic translation feature. While it increases quality of life for the player, it also takes away a learning opportunity. Generation is absent from both games, as having even one agent capable of meaningful conversation would require a notable time investment: *Sethian*, another language learning game based around communicating with a computer in an alien language, is fully built around a single conversation, and even then has heavy limitations to what the player can talk about.

These examples suggest that a game aiming to teach a language should look at maintaining the sense of mystery and focus on negotiation of meaning by using story and mechanics as sources of information on the language rather than direct instruction. It should also enhance the retrieval phase of vocabulary acquisition by removing automatic translation, but still keep some scaffolding to help the player and avoid confusion. Incorporating meaningful language generation in a game would probably prove a complex challenge both mechanically and narratively, but could be an important addition to learning.

## 6. Conclusion and Future Research

Commercial games like *Heaven's Vault* and *Chants of Sennaar* manage to integrate language learning into their core mechanics to create an engaging and immersive experience. By analyzing their design through SLA theory, this paper looks at the design elements these games employed, and proposes methods to integrate those elements into GBL approaches to language acquisition. Future work could look at other language learning commercial games such as *Sethian* or *Tunic*, or explore further how these principles can be integrated in GBL approaches and measure their effectiveness.

**Ethics Declaration:** Ethics clearance was not required for this research.

**AI Declaration:** No AI tools were used for this paper

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