**Abstract**

*This thesis presents findings from a study investigating the learning effect of video games from minimal exposure with young English language learners in Norway (N=40, aged 11–13), based on the ideas of embodiment, incidental learning, and commercial video games as a source for language learning. Data were collected through an experiment in which the participants filled out two identical glossary-style translation tests before and after a gaming session of Black & White (2001). The thesis also investigates the difference in learning effect when watching vs. playing the game, the effect of subtitles and the effect of target item conditions, of which items directly related to player action were the most interesting. Learning effects were found (12,8 %), showing the potential of commercial video games as an important activity in L2 acquisition.*

# Innhold

## 1. Introduction

The benefits of video games on L2 acquisition is a topic to which more and more research efforts are devoted. More specifically, how CALL (computer-assisted learning) occur outside of school through informal sources which L2 learners employ for recreation or other activities (Sundqvist, 2009; Sundqvist and Sylvén, 2012; 2014). Several studies point to positive correlations between playing video games and L2 acquisition (Ranalli, 2008; Chen and Yang, 2011). The difficulty lies in pin-pointing both the contributing factors, and the isolated effects of these factors. This study looks at L2 acquisition from minimal exposure, to see if the benefit of video games on L2 acquisition is strong enough to still take effect when the player only is exposed to the target item a single time during the gaming session, whilst at the same time being bombarded with all the other impressions and language the game provides.

Furthermore, additional conditions are used to specifically pin-point factors which enhance or limit L2 acquisition. Subtitles is an established enhancer of L2 acquisition in movies and television (Vulchanova et al., 2014; Wang, 2007; Markham, 1987), and the question then becomes if the same effects can be applied to L2 acquisition from video games. In addition, participants were divided into a "play" and a "watch" condition, to see if physically playing the game makes a difference, or if simply seeing and hearing the stimuli is enough for L2 acquisition.

Since the early beginnings of Pacman and Pong, technology and game design have improved to the point where the limitations are fewer than the possibilities for the industry. Captivating, addictive, exciting and fun, video games are becoming something everyone plays, rather than being restricted to a specific demography. In 2008 in the U.S., the video game industry, with its $11,7 billion in sales, surpassed the movie industry at $9,79 billion (Thorne, 2009:807). The movement of video games from underground culture to mainstream culture spurs the need to understand the effect the video games have on its players, of which language is a major component. Note that this thesis only deals with language input from the video game itself, and will not go into topics such as inter-player interaction, use of forums, etc.

## 2.0 Theory

### 2.1 Second language acquisition

In only a few decades, our world has undergone an amazing transformation. Through the technological and more specifically, the internet revolution, communication across borders, cultures and languages is now only a click away. This increasingly international world sets new standards for communication. Before, learning a second (or third or fourth) language could be a hobby or interest. Today, it is almost to be considered a necessity for education or work. Lightbrown states that adults and adolescents can 'acquire' a second language (Lightbrown, 2000:432). Ellis defines L2 acquisition as: "*The way in which people learn a language other than their mother tongue, inside or outside of a classroom*" (Ellis, 2013:365).

Input is critical for second language learning. VanPatten (2004:6) states that: "*input and output play complementary roles but that we cannot get around the basic fact that the fundamental source of linguistic data for acquisition is the input the learner receives*" and Verspoor et al. (2009) state that:

> For input to lead to acquisition or learning, it needs to be processed. Input processing involves using those strategies and mechanisms that help make connection between particular language forms and their meaning during comprehension. At the same time, comprehension is not limited to language processing, as one can comprehend a message by looking at a picture (Verspoor et al., 2009:62).

However, there are also limitations to second language acquisition. VanPatten (2004) distinguishes between *input* and *intake*, of which the latter is "*input that has been processed in the working memory and made available for further processing*" (VanPatten, 2004:6–7). Furthermore, According to Van Patten (2002), learners process input for meaning, before anything else. The implication of this is that learners can, because of limitations on their working memory and the nature of the learner's developing linguistic system, process input in ways that are less than optimal for acquisition (Van Patten, 2002:241). This is particularly relevant when dealing with acquisition from video games, as playing a game can be stressful for players. Also, another aspect of this is that learners will focus on what VanPatten (2004:8) calls "big words", which are the words that hold the key to the meaning of any given phrase, and skip the "little words", i.e. inflections on verbs and nouns.

Concerning input when dealing with minimal exposure specifically, Gullberg et al. states that: "*To understand which auditory and/or visual features in the input are noticed, attended to and taken as evidence of linguistic distinctions by learners, it is important to control the incoming string and its properties*" (Gullberg et al, 2010:7). However, for this thesis, the whole string was not controlled. Instead, only one word in the string was part of the experiment, and it is the properties of the single word that is of interest. Thus, this thesis deals with minimal exposure in a natural language environment, rather than controlled.

## 2.1 Learning from video games

### 2.1.1 Learning machines

Video games are by necessity designed to teach. They need to teach new players, in a short span of time, the basic mechanics of the game, whilst at the same time keeping the players entertained while learning. In addition to the very basic mechanics, many video games feature immensely complex systems, which at first glance would seem impossible to teach players. The Valve game *Dota 2* (2013) currently has 110 playable characters, which again have four different abilities each, with each ability having a different effect, cool down time before it can be used again, and cost to use. Combining this with knowing which of the 129 items to buy to enhance your character, when to accomplish different tasks (ganking, warding, etc), and when to fight and when to flee, teaching a player all these aspects seem like an impossible task. Yet the game succeeds in teaching this to its players, which after playing some *Dota 2* proceeds to play another game, like *Total War: Rome 2* (2013), which is equally complex, but in a totally different way, and thus the learning starts over again. To explain this, Gee in *Learning by design* lists principles of learning found in video games and argues that *good video games are in themselves learning machines from the start* (Gee, 2005:5).

### 2.1.2 Language acquisition features of video games

Whether one uses video games for language acquisition intentionally or unintentionally, the underlying principles that make video games good for language acquisition are the same. Purushotma, Thorne and Wheatley (2009) draw on the classroom idea of task-based language learning, and look at where it intersects with video game design.

> Task-Based Language Teaching (TBLT) proposes the notion of "task" as a central unit of planning and teaching. Although definitions of task vary in TBLT, there is a commonsensical understanding that a task is an activity or goal that is carried out using language, such as finding solutions to a puzzle, reading a map and giving

directions, making a telephone call, writing a letter, or reading a set of instructions and assembling a toy. (ibid, 2009:6).

The idea of TBLT is important for understanding why video games have such language teaching potential. The player is an active agent interacting and doing tasks that feel meaningful within a digital world that provides rich and varied language input that often combines visual cues, text, spoken language and context.

Furthermore, Purushotma, Thorne and Wheatly (2009) underline that "*gaming environments should not simply reproduce conventional foreign language pedagogy in a digital format*" (ibid, 2009:6). The focus is on TBLT and thus, "*the video game should provide a framework that emphasizes goal-directed activities within constructed gaming environments*" (ibid, 2009:6). Based on the intersection between TBLT and video games, they list the following ten principles for designing video games for foreign language learning:

1) At least as much thought needs to go into the design of failure states as for success states.
2) Instruction needs to ensure that learners focus predominantly on meaning or words or phrases; secondarily, however, instruction should still focus on form.
3) All elements of the game, particularly communication and input mechanisms should have a playful spirit to them.
4) Metalinguistic descriptions and terminology should be presented through optional supporting material, not as part of the core gameplay.
5) Learning content should be organized around tasks, not presented taxonomically.
6) New concepts should be introduced gradually and interspersed with other content before requiring difficult responses from players.
7) Assessment should intelligently track free production tasks throughout the game, not simply measure controlled production during test events.
8) Consider the full range of gaming platforms available
9) Games should allow students to spend extra time in activities they enjoy and to minimize time in ones they do not. Ultimately, instructional activities should be designed to teach students how they can autonomously continue playing similar games or performing similar activities taken directly from the target culture.
10) Where possible, multiplayer games should provide players with meaningful and distinct roles (Purushotma, Thorne and Wheatly, 2009:7–23).

While the list is intended for the design of edutainment, it can be applied to commercial games as well. This is important to the thesis as it can provide a guideline to which

commercial games are suited for language learning, by comparing the game to the features listed. For Black & White, being a simulation game, Purushotma, Thorne and Wheatly (2009:25) states that simulation games is a genre particularly well suited for beginner learners in classroom settings.

### 2.1.3 L2 learning from video games

Applying these principles to L2 acquisition specifically, a couple stand out as particularly interesting. Usually, a video game will lead players through the game through a series of well-ordered problems. These are problems that, according to Gee (2005), continuously challenge players to be creative in the use of the game mechanics in order to solve the problem they are facing. In extension, and most vital to L2 acquisition, is the principle of information "on demand" or "just in time". By giving players and information and tools required to solve problems *when they need it*, the need for understanding the information becomes immediate and vital to progressing in the game.

An additional aspect applicable to L2 learning is listed by Reinders (2012) in *Digital Games in Language Learning and Teaching*:

> [Video games] put performance before competence and they put experiences and actions before words and texts. This means players learn by doing, and that they have images and experiences to give deep meaning to the words and texts they read later, in order to resource their play and learning (Reinders, 2012:xii).

This describes how the language players are exposed to in a video game is accompanied by not only the visuals of the game, but a context which the players often will have created themselves. The language will most of the time be directly related to what the player has done of is about to do, enhancing the same *immediateness* as Gee (2005) points to. This also goes into the storytelling part of video games, which in a study by Cheng & Yang (2011:171), several participants reported the story as part of what kept them playing a game. Storytelling can involve the player emotionally, and exposes the player to dialogue and text in a larger context. Reinders names the way video games teach as "*teaching as designing*" (TAD). and makes the claim that "*TAD is a good deal closer to how people acquire new languages in situ, rather than in standard classrooms with text books and drill sheets*" (Reinders, 2012:xiii).

2.1.4 Interconnection of visual and word

Video games connect the written word, a picture, sound, a virtual 3D representation of the object in the game world and actions associated with the object. This make the players activate word processes on several different levels continuously and simultaneously, which has been proven to enhance word learning (Plass & Jones, 2005:472).

Plass and Jones (2005) constructed a model for multimedia-based second language learning by incorporating elements of the models of Chapelle (1998) and Ellis (1997)[1] with cognitive theory of multimedia learning (Plass & Jones, 2005:471).

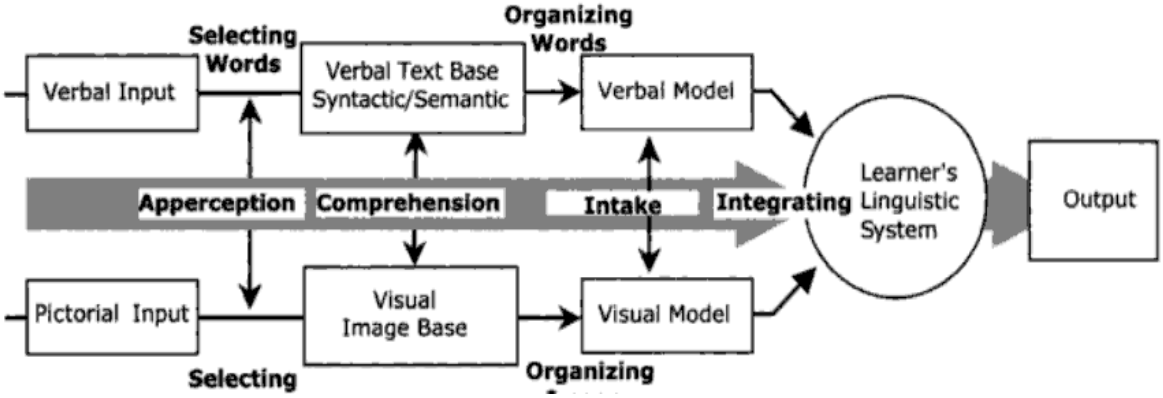


**Figure 1. Integrated model of second-language acquisition with multimedia**

This model integrates the visual input with the standard text input, illustrating how the two forms of input together integrate into the learner's linguistic system. The rows represent the two information-processing channels, with audio/verbal on top and pictorial/visual below. Moving along the model from left to right, we see the cognitive language processing phases, going from input through working memory in constructing the models to long term memory which is the learner's linguistic system, which then again can result in language output. The main point of the model is that these processes happen simultaneously.

2.1.5 Computer assisted language learning

A game that has undergone several studies for its application in computer assisted language learning (CALL) is the bestselling game *The Sims*. Ranalli (2008) looks at the game in a classroom situation, supported by the use of supplementary material and modified modes of play, to see if the entertainment game can be adapted to vocabulary learning. The study pays particular attention to the importance of the support material, and does find statistically significant differences between manipulations with and without supplementary materials such

[1] For more on this see Plass & Jones (2005) for references to Chapelle (1998) and Ellis (1997).

as dictionaries. This shows how commercial games when coupled with theoretical knowledge and pedagogical method can be applied to vocabulary learning, and that identifying not only the need for supplementary material and the nature of these, but which aspects of gameplay are best suited for language learning is an integral part of the adaptation of commercial games to the classroom.

This is relevant to this thesis, as it shows how a game can be adapted and enhanced by instruction and supplementary materials to facilitate language learning, building upon the game's already innate ability to teach vocabulary.

#### 2.1.6 Game mechanics and learning in video games

More commonly found in commercial games than in edutainment, video games have certain aspects which can interfere with a player's ability to learn language. Mayer & Moreno (2003) calls attention to a situation they brand *cognitive overload*. This situation occurs when the processing demands evoked by a situation exceeds the processing capacity of the cognitive system (Mayer & Moreno, 2003:45). A study by deHann, Reed & Kuwada (2010) shows how video games that are mechanically intensive leave less room for language learning. Based on Paas' cognitive load theory, the game puts too much stress on the player's working memory, thus impairing language learning. In this particular study, the game was *Guitar Hero*, but the effect apply to other games, including *Black & White*. For a new player, learning the navigation controls, understanding the setting and getting to know the new world are all aspects of gameplay which takes up working memory.

## 2.2 Naturalistic Exposure and Incidental Learning

### 2.2.1 Incidental Learning

Incidental learning is a key term when discussing the relationship between video games and language acquisition. This form of learning is a by-product, rather than the target of the main cognitive activity (Huckin and Coady, 1999:182). The idea is most commonly associated with extensive reading, where the reader encounters unknown words in context, and guesses the meaning of these. One of the problems of incidental learning is estimating what the effect of these encounters have on learning. In one of the early experiments, Nagy, Herman and Anderson (1985) found the probability of learning a word from context from just one exposure to be between 10–15%. While in a later study, Herman et al. (1987) estimated the probability of learning a word based on just one encounter to be as low as 5 %, but

considering the amount of variables involved in word learning, determining the probability of incidental learning from any number of exposures is problematic at best. Another key component is also the definition of when a word is deemed 'learned' or 'acquired'.

In response to the increased focus of the scientific community on the effect of just one exposure, Bogdanov (2012) emphasizes the need to understand incidental learning as a culmative process, and that "the research measuring one exposure to the target words represent an extremely narrow view of the notion of incidental vocabulary learning" (Bogdanov, 2012:77). For this thesis, we address words as learned or acquired based on single exposure in context, but recognize Bogdanov's point that incidental learning is a culmative process, and that it is difficult to separate incidental learning from single exposure from inferring meaning from context.

Identifying the mechanisms which enhance incidental learning is a still on-going process. Laufer & Hulstijn (2001) present a set of conclusions, of which these are the most important for this thesis:

> 1) Attention, with noticing as its subjective correlate, appears to play a crucial role in both implicit and explicit language learning. 6) There is at least one theory which subsumes need under motivation. Need creates tension. We understand this assertion to mean that a mild degree of tension may positively affect information processing, and therefore may indirectly affect learning. Laufer & Hulstijn (2001:9).

They proceed to introduce the idea of *involvement* which encompass these three factors: need, search, and evaluation. The idea is that the level of involvement can be used to explain and predict the success of a learner. For this thesis, the need aspect is the most interesting. This is the motivational, non-cognitive process, "the need to achieve". Laufer & Hulstijn distinguish between 'moderate' need, imposed by an external agent, and 'strong' need, imposed by the learner onto him- or herself. Based on the conclusions they present, need should facilitate incidental learning. *Involvement* builds on an aspect of incidental learning that is problematic in L2 learning terminology. Rieder (2003) problemizes the equation of 'incidental' with 'unconscious', and states that: "incidental vocabulary acquisition is non-explicit in so far as it does not involve an explicit learning intention (the overall goal of the learner is text comprehension), but that neither the process nor the product of such learning is necessarily implicit in the sense of non-conscious" (Rieder, 2003:26). This is significant for this thesis, as reading and playing a video game are two different modalities, with the video game being

more interactive, strengthening the "need" component of motivation, increasing the involvement of the participant.

### 2.2.2 Naturalistic exposure and immersion

Interconnected with incidental learning is naturalistic exposure to the target language. Muños (2008) defines naturalistic second language learning as "*learning through immersion in the second language environment*" (Muños, 2008:578) and goes on to point out to how exposure to the target language in formal education usually is structured and discontinuous, while with immersion, the L2 input is much greater and much more varied Muños (2008:578–579). This can be applied to video games, as Squire (2003:54) describes how good video game design immerses players in a rich interactive digital microworlds, with varying themes, content, environments and language depending on the game. Sundqvist and Sylvén (2014:3) shows in their study of Swedish children that they are extensively engaged in what Sundqvist (2009) calls *extramural English*, English outside of school, and how those children report both high motivation for learning English, and high in their self-assessed English ability. Furthermore Sundqvist and Sylvén (2012) shows how frequent gamers outperformed moderate gamers, who again outperform non-gamers, and their conclusion is that "*playing digital games at an early age can be important for L2 acquisition*" (Sundqvist and Sylvén, 2012:302).

## 2.3 Embodiment and situation models

There are several theories describing the comprehension of language. This thesis builds on the idea of embodiment as the foundation of language comprehension. Engelen et al. explains the general view of embodiment:

> It is a generally held view that when people comprehend language, they create a mental representation of the described state of affairs rather than the text itself. This representation is a situation model. According to the theories of embodied language comprehension, perceptual-motor simulations–not amodal propositions–are the building blocks of situation models (Engelen et al., 2011:660).

A consequence of the construction of such situation models is that readers feel that they are in the narrated situation, rather than outside it. They feel happy when good things happen in the story, and feel sad when misfortune strikes (Zwaan, 1999:15).

Engelen et al. (2011) point to two crucial aspects of language comprehension. The first of which is the ability to hold words and clauses in memory while processing new words and clauses until all can be integrated in the situation model. Tests show that high-level comprehenders are quicker to integrate new information into their models, thus implying that they are more efficient when processing new information. Another observation is that reading span increases during childhood, suggesting that older children have developed stronger activation links between words and their associated perceptual representations Engelen et al. (2011:662).

Second, the ability to comprehend and therefore accurately create a situation model of a given situation also depends on the individual's domain expertise. Holt and Beilock (2006) showed how athletes would more quickly than non-athletes process situations describing sport-specific scenarios, while showing no difference when processing everyday-situations. This suggests that possessing perceptual-motor representations depends on experience interacting with objects and performing the actions in question. Engelen et al. (2011, 662)

These two aspects of language comprehension are of interest, because when considering the amount of perceptual information that is given to a player of a video game, the implication is that a player will be able to construct very precise situation models while playing. Furthermore, these models will not be so dependent on the player's level of comprehension, as word-to-perceptual representation is found in the game, and domain expertise can be achieved through interacting with the virtual objects and the virtual world.

### 2.4 Effect of subtitles on L2 acquisition

Several studies have investigated and found that captions and subtitles enhance L2 acquisition when working with audiovisual material. Markham (1989) tested 76 ESL students of various English proficiency at an American university, and found that the English captions helped the students perform better in a multiple-choice comprehension test Markham (1989:39,41). In another study done by Wang (2007), Chinese students were tested with regards to meaning, word spelling and listening comprehension, and found that English captions, whilst enhancing all aspects, were particularly effective for the comprehension of meaning. In a recent study conducted by Vulchanova et al. (2015), positive effects were found when Norwegian teenagers watched an animated TV-show with subtitles in English.

> The combination of auditory material in the target language, verbal visual information, and nonverbal visual information in audio-visual material creates a better environment for learning than when only two of the three are available as input channels (Vulchanova et al, 2015:6–7).

All of these studies argue that captions and subtitles have a positive effect on L2 learning from audiovisual material. However, all of these studies have dealt with television clips and shows, where the recipient is passive, while when playing a video game, the recipient is usually more active.

## 2.1 Research questions

The main research question is:

- Can L2 acquisition occur from video games with minimal exposure?

And the thesis also explores the following subset of questions:

- Which types of words are more easily learned from minimal exposure (verb, nouns, concrete, abstract, tied to player action)?
- Do subtitles in the context of video games have a positive impact on minimal exposure learning?
- Do we find a difference between playing vs. watching the game in learning on minimal exposure?

## 2.2 Method

### 2.2.1 Participants

Forty Norwegian secondary school students participated in the experiment (mean age 12:5, range: 11:10–13:7, 21 girls). The age group was chosen because of their still basic but adequate L2 skill level, which allowed for testing of words above the very basic level. Children with language and learning deficits were excluded through preselection by the class

teacher. However, it was specified to the teacher that pupils of all proficiencies were welcome in the experiment. All the participants have Norwegian as their L1 and learn English as an L2 in school.

### 2.2.2 Black & White

*Black & White* is a simulation game developed by Lionhead Studios™ released in 2001. The player is a young god learning to do miracles like making it rain, casting fireballs or summoning a flock of doves, controlling and training your pet creature, and caring (or not caring) for your subjects, a tribal village on a medieval technological level. All actions in the game and your only interaction with the game world is through an animated hand which is controlled by the mouse, giving the game a sense of tactility. The viewing angle is first person, as you see through the eyes of this young god. This means the actual appearance of your avatar is never revealed. However, all the other gods in the game is depicted simply as floating balls of light. The gameplay revolves around doing tasks, increasing your godly power and defeating other gods by destroying their seat of power, a temple. The creature you control has the form of an animal walking on two legs and needs to be trained to behave as you would like it to behave, much as you would train a pet dog. As a god, the player can choose to be either good or evil. This decision does not only influence gameplay, it also determines the visual appearance of the game.

The game was chosen for this thesis because of its tutorial. Challenges with testing language learning effects in video games is the freedom of gameplay each game has, making it difficult to get comparable learning situations, as each player experiences the game and thus its language differently. In Black & White however, the first part of the game is a very linear tutorial teaching the player the basic movements and mechanics of the game, with scripted scenes and dialogue popping up at set and predictable intervals. Therefore, the game allows for a situation where we can guarantee that all the participants have been exposed to the same language, as they proceed through the compulsory cutscenes and dialogues of the game.

## 2.3. Materials

### 2.3.1 Vocabulary

Using gameplay footage from a video series on youtube, featuring a person playing the game, the vocabulary of the mandatory part of game was transcribed and systematized. The vocabulary of the videos match the vocabulary of the game exactly, and match the language the participants were exposed to. All the language of the mandatory part was transcribed in full. The mandatory parts of the game are all the cutscenes, dialogues, comments and actions that the player will, with 100 % certainty, experience during the gaming session. Participants may, through their gaming session, trigger certain extra language components like encouraging messages when not completing a task on the first try or failing tasks. These were not transcribed, but were checked and contained none of the target items. In total, the target items consist of 14 nouns and 14 verbs. All participants were exposed to all of the words plus an additional 14 (7 nouns) filler words in a glossary style translation test before and after the gaming part of the experiment.

In order to systematize where in the game the language was found, the transcription was based around cut scenes or episodes, and therefore has a clearly marked beginning and end, easing the process of locating specific language later. The transcription was made with regard to both which character in the game was speaking, and any player interference or action taken during cutscenes.

After the language was transcribed, the systematization process began. All nouns and verbs were listed in two separate lists. Several criteria were decided upon, and all the words on the lists that did not fulfil these were eliminated from the set that would finally make up the target items.

These criteria were as follows: The target item must only occur once in the mandatory part of the game; the Norwegian translation of the word must not be too close to the source word typographically or phonetically; the target item must not be common to the extent that we can safely assume that almost all 12-year olds would know it (e.g. <boy>); the target item must be limited to one word class within the language of the game (excluding for instance <need>); the target item must not be a derivate of a root (e.g. <villager>); the target item must be subtitled when the setting is turned to “on” and not subtitled when the setting is “off”; the

target item or its translation must not be a compound. Naturally, a lot of words fall into several of these categories.

After these restrictions were applied, the words were rated after how likely we believed it to be that a 12-year old would know and could translate the word. Based on this we were able to further refine the list of final words by including both words we deemed it likely and words we found it to be unlikely the participants would know, based on aspects such as frequency and how technical a word is. For instance, we deemed it likely that participants would know <arrive> and <direction>, but unlikely they would know <quarry> and <aeon>.

Because of these strict constraints, the target item list of nouns grew short by one word. We therefore included <signpost> despite it being a compound to get the final number of nouns up to 14, on par with the verbs. Its only conflict with the requirements is that it is a compound.

To this selection we added 14 filler words (7 nouns and 7 verbs), bringing the total up to 42 words. These filler words are to a large extent limited by the same criteria as the target items, with the following exceptions: The filler words are all common and very basic words that the participants would most likely know and none of them are found in the game, like <bird> and <teach>.

To further enhance the experiment, two manipulations were added, making up a total of four conditions. These were playing or watching a video of the game, and subtitles on or off. This gave us a total of four conditions: Group A play / subtitles on; Group B play / subtitles off; Group C watch / subtitles on; Group D watch / subtitles off. Each test group consisted of 10 participants (5 girls). One test group had six girls and four boys.

### 2.3.2 Concrete, abstract and player actions

Several categories were made to further distinguish the target items, as the nature of the word and its context might affect learning. Nouns were sorted based on being abstract or concrete. Target items were also categorized by whether they are directly related to an action the player have to make in the game or not. The criteria of the player action-category are that the target item occurs either immediately before or after an action is taken; the target item is an integral part of the action; the target item is either an action, the target of an action or vital to performing the action.

## 2.4 Procedure

The experiment setup was a table or desk with a chair in front of it. On the surface was a laptop with its screen either off or shut. Connected to the computer was a headset and a mouse if the participant was in the “play-condition”, and only a headset for the “watch-condition”. In front of the computer was “translation test” (see appendix C and E) with its front page up.

One to four children were tested simultaneously in a room. In the “play-condition”, the max number was two. They were told to sit down , and start reading the front page of “translation test”. After about a minute they were given the signal to flip the page. This marked the start of the experiment.

After the children finished “translation test”, they were given the instruction sheet for video or play-condition (appendices A and B). They put on the headset and the gaming session started immediately. The instructions were given and the gaming session initiated as each participant finished “translation task”. During the gaming session, the “watch-condition” require no interference at all. In cases where the participant obviously struggled to find the objects needed to progress in the “play-condition”, time constraints warrant pointing the participant in the direction. No vocal feedback was given in these instances. Interference was limited to moving the ingame camera to show the object needed to proceed in the game.

Immediately after the gaming session was concluded, the participants were given “translation test 2” (appendix D and E). The test itself is identical to “translation test”, only the front page is different. They read the front page and started the test right away. When finished, the participants were given the “game questionnaire”, to see if they had paid attention to the game. If several participants were tested simultaneously, the participants were told the experiment was finished when the last of the participants had finished page one of the “game questionnaire”. The second page of “game questionnaire” was simply a set of fun tasks to pass the time if one of the participants took longer time finishing the experiment.

The experiment took approximately 50 minutes to complete in the “play-condition” and 40 minutes in the “watch-condition”.

### 2.4.1 The play and watch conditions

For the participants in the “watch-condition”, we used a recorded gameplay session, in which a person played through the part of the game the participants would play, captured by the recording software “Fraps”. Two of these sessions were recorded, one with and one without subtitles. While the videos are not complete mirrors of each other, all aspects involving mandatory language are be the same. Having the videos be completely identical is not possible, because player camera movements are impossible to replicate exactly. The dialogues and cut scenes of the game are scripted, with sets of predefined camera movements. Thus, these are identical in both the recorded videos.

In the “play-condition”, matters are more complicated. The player is free to act as he or she pleases, and while the game shows you a path to follow, it is up to the player to follow it. Therefore, each “play-condition” will be unique in terms of length and what other optional cut scenes or other bits of language the player encounters. However, the target items are not found in this optional language, with the exception of one instance of <power>, which is found in an optional task. This means participants in the “play-condition” might encounter that target item twice. However, the two instances of learning with the target item <power> happened in the “watch-condition”.

Also each “play-condition” participant will have a different experience of the game. Some might struggle to find the objects required to proceed, some might struggle with the camera movement, some might find the game boring, etc.

The game was set to its highest default resolution, which is 1024 x 768. Screen size were 15,4” and 15,6”. The participants were seated, and chose the distance from eyes to screen for themselves.

## 3.0 Results

### 3.1 Scoring procedure

When judging the correctness of the translations, the following two aspects were taken into consideration. The translation tests mixed verbs and nouns unsystematically. Therefore, if a translation provided the noun related to the verb or vice versa, the translation was considered to be correct, like the case of “to hunt (verb) -> en jeger (noun, but derivate of correct verb)”.

There was no requirement for the word to be correctly spelled. If the word written on the sheet was a misspelled version of the correct translation, and if the misspelling was a word in Norwegian but not a competing word, the response was coded as correct.

In coding it was decided to have a total of four categories to determine the degree of correctness of the translations. These were blank “B”; wrong “W”; close “C”; perfect “P”.

For a translation to be “C”, it had to be semantically close to the correct translation. This means that the translation must have same general semantic idea as a “P”. Here follows a list of examples with explanations of why they fit the “C-category”.

To push -> å trekke – the semantic meaning is an action taken to move something in a direction. In this case, the direction is the opposite of the “P”, but is still semantically close.

To worship -> å hylle - the semantic idea of holding something or someone higher than oneself is preserved in the incorrect translation, and it is therefore “C”.

A ground -> en grunn – two reason for this to be “C”. <Grounds> has a semantically similar use in legal terminology, and in many compounds related to translations of <ground> contain <grunn> e.g. <berggrunn>.

To worship -> å respektere – to respect something is similar though a less extreme relation between two entities.

To retrieve -> å gi tilbake - while the idea of retrieve is to get something, there is an implicit receiver involved. Therefore, this translation is “C”.

For a translation to be considered perfect, it had to be a correct translation of the word. Note that several of the words have correct translation which is not encompassed by the game context. These are however still correct translations, and were considered to be perfect translations. An example of this is “a power -> strøm”.

## 3.2 Data handling

Pupils which in the preliminary questionnaire marked having a parent or parents to whom they spoke another language, or having stayed or lived for a long period of time in a country speaking another language were also removed from the final group of participants.

After the experiment was concluded, two of the participants showed clear signs of having language or learning disabilities. These were replaced by new participants, bringing the total of participants tested during the course of the experiment to 42.

### 3.3 Analysis of data

The goal of this thesis is to see if someone playing a video game can experience a learning effect from minimal exposure. The definition of learning for the purpose of this analysis, is if a participant's translation of a word moves up the ladder in terms of correctness. For example, a participant translates a word to “C” in test one, and proceeds to translate it to “P” in the second test. This would be learning by this definition. Instances that are not counted as learning are “B” (blank or no input) in test one changed to “W” (wrong) in test two; same level of correctness in both tests; and moving down the ladder, for example “C” in test one and “B” in test two.

In total, there are 1120 words that have been subject to translation by the participants, excluding the filler words. Each participant attempted to translate 28 words. In order to examine instances of learning, it is necessary to first remove the instances where it is clear that the participant already knew the word, leaving it ineligible to any form of learning process. These are the words which participants translated to “P” in both tests. This excludes 497 of the 1120, a total of 44,4 %.

Of the 623 words remaining, 80 are instances of learning, a total of 12,8 %. A generalized linear mixed model analysis was performed in R (package lme4) on the ‘Learned’ binomial variable (via a logit link) with Participant and Item as random effects and the Game, Subtitle, Player Action and Word Class conditions as fixed effects. No significant effects of the fixed variables on the Learned dependent variable were found (all $p > .05$). Despite having found no statistical significance, it is still worth taking a look at the results.

Out of the 80 instances of learned, we see that:

- 39 are verbs and 41 are nouns, almost 50 – 50.
- 42 are in the “watch-condition” and 38 in the “play-condition”, almost 50 – 50.
- 35 (17 play-condition) are with subtitles “on" and 45 (21 play-condition) with subtitles “off", 43 – 57.

- Of the nouns, 23 are concrete and 18 are abstract.
- 29 (17 in play-condition) are tied to a player action, 36 %.

## 4.0 Discussion

Before starting the discussion, it is important not to over generalize the findings presented in this thesis, as the research sample was fairly small, in addition to the minimal exposure. This is particularly important when discussing the effects of the various conditions. Whilst no significant effects were found for the various conditions in this sample, there is a tendency which will be discussed further, in addition to the fact that even with minimal exposure, there were still learning effects.

### 4.1 Learning Effects

The learning effects were in addition much stronger than the 5 % estimated by Herman et al. (1987), but within the interval estimated by Nagy, Herman & Anderson (1985). A relevant question is if the learning effects can be contributed to incidental learning. Huckin & Coady (1999) defined incidental learning as learning that is a by-product rather than the target of the main cognitive activity, and therefore, by Huckin's definition, any learning from a video game played for recreation is incidental. However, bringing Bogdanov's (2012) point about incidental learning as a culmative process into the discussion, one must be careful before attributing the learning effect solely to the minimal exposure the participants had in this experiment. The language input any of the participants have outside of the experiment cannot be controlled, and it is therefore possible that the minimal exposure the participant had to a learned target item was not the first, but the second, third or fourth. The natural conclusions that follow from this are that: We see learning effects from the minimal exposure in the experiment; this learning is incidental by definition; we cannot conclusively say that the minimal exposure is the sole reason for learning, as we cannot control the L2 acquisition processes of the participants.

The main research question was if learning from video games can occur at minimal exposure. Despite the vast amount of language the participants were exposed to during their session, positive learning results were found. Moreover, there were great variety in the words learned, from the basic <pull> and <arrive> to the much more advanced <quarry> and <aeon>. There are several factors that can explain the positive learning effects of the video game.

## 4.2 The language learning potential of Black & White

Looking at the learning potential of *Black & White* specifically, we see that the game is well suited for learning. Firstly, it provides, as Squire (2003) describes, immersion in a second language environment, and therefore, is a setting in which naturalistic second language learning as defined Muños (2008) can occur. Secondly, we see the potential based on the principles listed by Purushotma, Thorne & Wheatley (2009). Going through their list of principles for foreign language learning, a couple stand out as particularly applicable to *Black & White*.

1) Failure states vs. success states: When doing tasks in *Black & White*, if the player is not completing them in the correct manner, reminders or hints will be provided by the game. If the task is failed completely, the game will reset the task and the player will be allowed to start over. The instructions for the task will be repeated as if it was the first time the player started the task. This applies to all the tasks on the first world (the participants in the experiment only played part of the first world). Thus, players who do not understand the task at first, and proceeds by trial and error, is not punished by the game. Rather, they are rewarded for their efforts by being given hints, and if they fail completely, given another attempt.

3) Playful spirit to all the elements of the game: The bantering of the two helpers, the good and evil consciousness, the way instructions are presented through dialogue between these two characters, and the general atmosphere created by the design yields a game that focuses on fun and exploring the new world and your new powers as a god. Note that playful does not necessarily mean silly. Several dialogues encountered by the participants of the experiment are serious, solemn or sinister, but they are parts making up a playful whole, and also builds the story of the game, which importance is underlined by Cheng & Yang (2011), and builds emotional connection as stated by Zwaan (1999). This playfulness keep the game fun, which engages the player while playing, and provides an incentive to either keep playing, or play the game again later.

5) Learning content organized around tasks: A point where the principal difference in intention between edutainment and entertainment comes into play, as *Black & White* does not aim to teach the player anything other than the rule set of its world. The point is however valid for both, not for how the way the learning material in itself is organized through tasks in

*Black & White*, but how the game itself is organized as a series of small and great tasks. Each task has a set of instructions, which must be understood in order to complete the task. This provides the player with a ever changing set of subgoals, with particular language associated with each one. The instructions are given when needed, as Gee (2005) and Reinders (2012) emphasize. The need to complete tasks compels the player to strive for understanding, as Laufer & Hulstijn (2001) point to.

6) New content introduced gradually: *Black & White* does like many other good video games do, it introduces basic mechanics, play with them for a while, and then introduce a new mechanic for the player to experiment with. This goes back to Gee's (2005) point about continuously challenging players to explore and be creative in their use of the game mechanics. The tutorial of *Black & White*, which is what the participants in the experiment played parts of, does this through instructing dialogue and trial and error by the player, combining the points from 1), 3) and 5) into the process which is learning the game, while at the same time, giving authentic foreign language input to the player.

### 4.3 Rich input

VanPatten (2002, 2004) underlines the importance of input in second language acquisition. When dealing with the richness of the input from video games, it is important to recall that for learning or acquisition to take place, input must be processed, as stated by Verspoor et al. (2009). In video games, the input is characterized by its multimedial form. The interplay between visual representation and word is one of the factors that can explain the learning we have observed. In the model by Plass and Jones (2005) we see how the word and the visual is connected, and this added information, when compared to reading or listening, help the L2 learners build accurate situation models as proposed by Engelen et al. (2011). As stated by Vulchanova et al. (2014), the combination of auditory material, verbal visual information and nonverbal visual information offers a better environment for learning than when only two of the three channels are available. It is the richness of the input that make video games particularly well suited for L2 acquisition. Seeing how this effect is present in almost every video game and will thus be applicable to a lot of language in video games, it can be considered one of the most important aspects of CALL, both formal and informal, and has uses for learning vocabulary, domain-specific language and more conversational English, depending on the game. By playing *The Sims* vocabulary combined with visuals teach both

domain-specific language related to houses and furniture, and related to interaction between people, while role-playing games like *Skyrim* feature more conversations and full texts.

Further adding to the learning effect is context and a sense of purpose. Gee (2005) points to how players are driven by motivation. You are not simply pulling a rope, you are pulling a rope to save someone, to move something, to progress and see what happens next. Thus, understanding the language in a game is vital in order to progress, and therefore the player is motivated to understand and learn the language. Furthermore, Zwaan (1999) points to the emotional connection a reader has with a narrated situation, and this is applicable to the experienced situation within a video game as well.

For the sub questions several conditions were included in the experiment, in order to not only see if there was learning from minimal exposure, but if there were specific elements that enhanced the learning process.

### 4.4 Play and watch

First, we examine the play and watch condition. Based on embodiment theory (Engelen, 2011), it can be assumed that a player actually playing the game, would form a stronger attachment to the actions taken ingame, creating a more accurate situation model and thus easing the learning process, making the participants in the play-condition learn more words than participants in the watch-condition. It is also natural to assume that the ideas of Zwaan (1999), which says that the player is emotionally invested in the world and what happens in it, would apply more to participants in the play-condition. However, as the numbers show, this was not the case, as the distribution is almost 50–50.

This result can be explained by several different elements. Seeing as the data set is limited at this stage, it is possible that any effect of playing versus watching has not been uncovered simply because of lack of sufficient data. Another reason might be the issue of cognitive overload, as described by Mayer & Moreno (2003), and backed up by the results of deHann, Reed & Kuwada (2010) and the ideas of VanPatten (2002), where participants playing *Black & White* for the first time with new controls, navigation, context, etc has less attention to spent on language, because of the cognitive stress of merely playing the game, whilst participants watching do not suffer from this extra cognitive load. Based on the findings by deHann, Reed & Kuwada (2010), participants watching the game should therefore score

better than the participants playing, but again, this is not the case, suggesting that playing has some positive effect on learning that watching do not, and therefore that if participants had played a game they were familiar with, already having learned the controls, this should have a positive effect on learning.

### 4.5 Subtitles

A rather surprising result was the distribution of words learned being in favour of subtitles "off" rather than "on". Seeing as all the studies mentioned points to positive results when using subtitles for language acquisition (Vulchanova et al., 2015; Markham, 1989; Wang, 2007), it was expected to find the same result for this experiment. There can be several explanations as to why we see the numbers be in favour of subtitles "off". Firstly, this can simply be a case of not enough statistical data, where our limited selection yields this result, while a bigger data set under the same conditions would yield a more even result or even favour subtitles "on", as the studies would suggest. On the other hand, it is also possible that the role of the player as a more active agent interferes with the learning effect of subtitles, building on VanPatten's (2002) and Verspoor's (2009) ideas on input processing. Watching TV-shows or movies, as the subtitles research usually have its participants do, leaves the participant more passive than is the case with video games. There is a distinct lack of research done on the effect of subtitles from video games, and seeing how it is a medium on the rise and increasing in its importance as a cultural phenomena, more studies should be devoted to this issue.

### 4.6 Player Action

Another aspect we looked at was words tied to player action. Of the words learned, 36,6 % were words tied to action. This is interesting, as only 28,6 % of the test words were tied to an action. Whilst not statistically significant in our experiment, this results was the one closest to having $p<0,05$, and therefore a tendency worth examining. When viewing the result in light of embodiment theory (Engelen, 2011), it is logical that language directly connected to actions taken by the player ingame should be easier to learn than language not directly related to an action, for example language related to building story or context. When building situation models based on perceptual-motor simulations, actions help build very accurate models, enhancing learning. This also goes back to VanPatten's (2004) point about second language learners focusing on the "big words" of a phrase. When being told by the game to perform a

specific action, the “big words” of such a phrase will be what do to, and what to do it with. Reinders (2012) also focus on the learning by doing-aspect of video games, where actions give meaning to words rather than the other way around. Furthermore, Purushotma, Thorne and Wheatly (2009) and Gee (2005) all stress the importance of tasks and performing meaningful actions as part of the learning mechanism of video games. In addition, 17 out of the 29 (59 %) instances of learning words tied to player action occurred in the play-condition, which support the argument that actions taken by the player enhances learning. Although the data set is limited, the tendency is there, and ought to be subject to more research.

## 5.0 Conclusion

Incidental L2 learning occurs when playing video games with minimal exposure. This suggests that with repetition of target items within one gaming session, and replaying the same session, the learning effects of video games on language acquisition should be even greater than measured in this thesis, leaving promise for the use of video games originally designed for entertainment for CALL, and promise for the L2 language skills of avid gamers. What remains unanswered is whether video games are *more* effective than for instance, reading or watching TV-shows and movies, a question to which more research effort should be devoted. No statistical significance was found in the characteristics of the target items learned, but the target items related to player action showed the most promise, and more research should be devoted to exploring the effects of this category. The results regarding subtitles and playing vs. watching the game were inconclusive, and a larger dataset should be used when exploring these issues.

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## Appendices

### Appendix A – Instructions given to play-condition

Du vil nå få spille et dataspill. Følg med, du vil bli stilt spørsmål om spillet etterpå.

**Appendix B – Instructions given to watch-condition**

Du vil nå bli vist en video av et dataspill. Følg med, du vil bli stilt spørsmål om spillet etterpå.

Appendix C – Translation test front page

Oversettelsesoppgave

I denne oppgaven ønsker vi at du skal oversette ord fra engelsk til norsk. Oppgaven inneholder både verb (å gjøre) og substantiv (et tre). Prøv så godt du kan å oversette alle. Oppgaven er på tre sider.

Når du er ferdig leverer du arkene til meg. Lykke til!

Appendix D - Translation test 2 front page

Oversettelsesoppgave 2

Her er samme oppgaven som i sted, prøv å se hvilke du kan nå. Denne oppgaven er igjen på tre sider.

Når du er ferdig leverer du arkene til meg. Lykke til!

Appendix E - Translation test word list

ask: _____

bird: _____

mountain: _____

forget: _____

edge: _____

pull: _____

education: _____

remember: _____

motion: _____

evil: _____

search: _____

quarry: _____

drop: _____

rumour: _____

forgive: _____

ground: _____

hunt: _____

arrive: _____

power: _____

expect: _____

write: _____

truth: _____

protect: _____

entrance: _____

change: _____

moment: _____

worship: _____

signpost: _____

suffer: _____

car: _____

explain: _____

aeon: _____

leave: _____

tribe: _____

pray: _____

mercy: _____

retrieve: _____

justice: _____

teach: _____

cloud: _____

direction: _____

provide: _____

Appendix F – Game questionnaire

## Spørsmål om spillet

1. Hva holdt på å spise den lille gutten i starten?

2. Landsbyen trengte hjelp med å bygge stort byggverk, hva slags bygg var dette?

3. Hvilket dyr valgte du og hvorfor?

Nå er du ferdig. Sitt stille og vent til jeg sier at vi er ferdige. På baksiden finner du noen morsomme oppgaver du kan holde på med imens.