Entertaining mobile learning of foreign languages

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Contents

Abstract

This research paper presents and tests the hypothesis that entertaining visual content can have a positive effect on learners' motivation and knowledge improvement when studying foreign vocabulary with a mobile device. A web-based prototype of a language learning application was built and an experiment with 18 participants who studied a set of about 60 Spanish words was conducted. The master thesis reviewed the research of leading authors in the fields of mobile learning, language learning motivation theory and memetics.

The entertaining content used in the experiment consisted of humorous image memes, a part of contemporary online culture. The treatment group participants, exposed to this content, spent voluntarily longer time learning with their smartphones than control group learners, who were exposed to images with neutral content, and stated directly that they felt more motivated to study. Entertaining content had a positive effect on learners' executive motivation. Moreover, the perceived improvement of language skills of these learners was higher.

The author argues that mobile learning with entertaining image memes is authentic, personalized and contextualized.

One major implication of this research paper is that methods for stimulating learners' extrinsic motivation in popular language learning applications (gamification approach) can be complemented by introducing humorous content to engage users on a more intrinsic level.

1. Introduction

As of early 2013, mobile phone penetration was estimated at 96% globally and 128% in developed countries (ITU, 2013), reflecting individuals' ownership of more than one phone. Mobility shapes every aspect of people's life more than ever before with applications affecting the ways of communication, work ethos, dating, leisure time, shopping, health, sports and many more. Education is not an exception.

One of the first definitions of mobile learning was putting it in an inseparable connection with e-learning. Mobile learning was seen as "e-learning independent of location in time or space" (Quinn, 2000). Years later in 2007, the scientific understanding of mobile learning developed to view it as "the processes of coming to know through conversations across multiple contexts among people and personal interactive technologies" (Sharples et al., 2009). A moderate modern view sees mobile learning as "a "noisy" phenomenon where context is everything" (Traxler, 2007)

The key advantages of mobile learning when compared with the more general category of e-learning include learners' answered demand for just-in-time learning that can occur in various times of the day or night, independent of one's place, and, preferably, in small informational chunks. This paradigm shift was firstly expressed by Rosenberg (2001) with his famous in the scientific spheres statement about "just in time, just enough and just for me" way of learning. Other beneficial features include its conciseness and easy transportability, offering a lot of information extremely quickly (Sharples et al., 2009).

Mobile language learning has meanwhile become an almost mainstream trend and a lucrative business. Albeit there are not many mobile-only educational platforms, innovative companies like Babbel, founded in 2007 (Babbel, 2015), Duolingo, founded in 2011 (CrunchBase, 2015), and Busuu, founded in 2008 (CrunchBase, 2015), have managed to put the incumbents in the e-learning industry such as Rosetta Stone under serious pressure, as can be discerned by its acquisition of Live Mocha, another successful online language learning community in 2013 (Crook, 2013). One of the reasons was the ability of these companies to engage users on both their online desktop computers, and their smartphones. Collectively, the three biggest (mobile) learning platforms mentioned above pledge they have some 150 million active users (CrunchBase, 2015).

According to the Horizon Report 2014 (Johnson et al., 2014) education is currently being transformed by trends such as the growing ubiquity of social media and a shift from the understanding of students as consumers to students as creators. Among the challenges for traditional educational institutions or instructional practices are the unaddressed demand for personalized learning and the insufficient levels of authentic learning.

According to Traxler (2007) there is a strong need to examine the pedagogies that are suitable for mobile learning, and to conceptualize mobile learning from the perspective of learners' experiences rather than the affordances of the technology tools. In this paper a strong emphasis is put on personalization and authenticity of learning.

Assuming an application is highly personalized learners experience a high degree of agency using it. Activities are adapted to meet the different learning styles of learners. The authenticity concept suggests that learning tasks have a real world relevance and a personal meaning. Radinsky et al. (2001) stipulate that activities are authentic if either they are done in a simulated learning environment, or there is a direct participation in the actual work of the focus community. Situatedness and contextualization are thus central to this concept.

In this mater thesis a novel language learning approach based on an already existing mobile trend, the viral image memes, is presented and analysed from the viewpoint of personalized and authentic language learning and the consumption of entertaining and humorous media for educational purposes.

In general, literature on humour and education is more concerned with classroom teaching and teacher's behaviour. There is strong confirmation that humour is an effective tool for instruction (Askildson, 2005) since it helps to reduce the emotional barriers between teachers and students and increases students' interest in subject matter. Laughter can also increase students' participation levels in language classes, strengthen the feeling of belonging to a group, and diminish the sense of vulnerability in case of a mistake (Azizinezhad, 2011). A still open question is to prove that similar effects can also be observed in online education without the presence of an instructor.

Although entertainment on smartphones is in some aspects not yet as variable as on other computer devices e.g. in the field of gaming or concerning the quality of video-consumption, in others it has created a world of its own. Services like Snapchat, Vine or Instagram could only be imagined on a smartphone. Mobility is the trivial reason for the phenomenon of „take to bed technologies". It is, however, the achievement of only some applications such as 9GAG, a popular online platform for user-generated entertaining images and videos, or Facebook to keep users hooked on the small smartphone screens for dozens of minutes per day in their most private place at home (Constine, 2014).

Having in mind the huge amount of time spent on such platforms for entertainment, it is not surprising that there is also an interest in the possibility of using the potential of such means for achieving other goals incl. educational ones (Cornillie, 2012, Blattner, 2012). But how do entertainment platforms or games achieve their high usage rate?

"Wordz" (Wordz, 2015) is a mobile game based on an old concept of finding words, hidden in a set of letters arranged in rows and columns. One of the reasons for the success of the game is that it is multi-player, only allowing users to play against each other in brief competitions. The game is usually played in the mother tongue of the user but for advanced language-speakers playing in a foreign language is also an option. In "4 pictures – 1 word" (4 pictures – 1 word, 2015) users have to guess a word based on the hints hidden in some common feature of four different pictures. Another example of a mobile game involving a high level of language mastery is "94%" (94%, 2015) where one has to guess a set of words that are the most frequent answers to a question. All these games for the mind do not have as a goal to teach users a specific language skill. They seem, however, to be great examples of how to involve users by introducing both extrinsic motivation via gamification or multiplayer features, and intrinsic motivation due to the highly addictive nature of playing. Among the common features of these games is their brevity, the quick progress (at least in the beginning) that is responsible for the feeling of connectedness with the game as if the user has invested more than their time in it (Eyal, 2014), their extensive use of gamification tactics such as levels increasing in complexity or points, and their nature to offer a true sense of achievement as soon as user succeeds at even a pointless task.

From a neuroscience point of view, humorous image memes attached with a language learning capability address the episodic memory of a person (Schachter, 2011). The

entertaining pictures appeal to personal experiences of viewers which are, however, common for many people (e.g. frequently observed socially awkward situations, clichés etc.) (Schifman, 2013).

The vast majority of literature about memes views them in the light of politics and culture (Schifman, 2013). The psychological effects on users are less explored. A fact that is, however, of great interest for this expose is that frequent users of platforms such as 9GAG can be defined as members of meme subcultures (Lin, 2014). They all share similar and personal emotions expressed by producing and consuming memes. Even newcomers can easily and quickly understand unfamiliar memes (Lin, 2014) Assuming a transfer of these features to the application analysed in this research paper, learning could be much more personal and authentic since even content by others will be emotionally understood as one's own.

Platforms such as 9GAG are used at any time, at any place: in public transport, in bed before going to sleep, at random events etc. Assuming, this could be achieved in the new language learning platform one will be able to truly observe ubiquitous personalized learning.

The purpose of this experimental study was to assess whether the introduction of humorous visual content in a mobile language learning application can effectively increase learners' motivation to study and measure the subjective effectiveness of the learning process. The context was learning basic Spanish vocabulary and phrases.

The master thesis goes on as follows. In Section 2 a literature review dedicated to mobile language learning, motivation and humour in education will be presented. Section 3 will introduce the design of the system, a web-based application for language learning in which the experiment takes place. Furthermore, in section 4 the methodology of the experiment is discussed and in section 5 the results are presented and analysed. A discussion and a conclusion follow in, respectively, section 6 and 7.

1. Literature review

1.1. Humor in language learning

Without the need to elaborate on all possible meanings and dimensions of the concept of "humor", here we use its common definition as "the quality of being amusing or comic,

causing laughter"[1]. Whether a situation or an object are humorous to a person, depends on various factors such as culture, personal experience and taste, mood, context and education. Thus humor is not absolute.

The three leading theories of humor are relief theory, superiority theory and the incongruity theory (Buijzen, 2004). Their functions are, respectively, physiological, emotional and cognitive. According to relief theory, laughing is necessary to decrease physiological tension over time (Meyer, 2000). Humor reveals suppressed desires and is used to overcome sociocultural inhibitions and therefore its content is often about sexual and aggressive topics (Schaeffer, 1981). Superiority theory suggests that laughter is caused by people's sense of superiority or victory over others (Meyer, 2000). Thus by joking and laughing self-confidence is built. Its content is often about ridiculing the different or less fortunate ones (Berger, 1993). According to incongruity theory, the object of people's laugh are unexpected or surprising things (Berger, 1993). Necessary for this type of humor is the cognitive ability to discover and understand situations that do not fit in the regular patterns. Its content is often about absurd and surprising events and behaviors (Berger, 1993). Although particular situations might not be amusing to all, the general concept of humor and its advantages and effects are universal independent of culture or language (Trachtenberg, 1979).

As far as humor in language education is concerned, it is usually employed in the context of traditional classroom teaching. There are several reasons why teachers use humor among which its relaxing and tension reducing effect, "its humanizing effect on teacher image" and its positive role in increasing student enjoyment and interest in the subject (Neuliep, 1991). Thus humor is not "a strategy for increasing student comprehension and learning" but crucial for its influence on the classroom environment (Neuliep, 1991). Moreover, as Welker (1977) suggests humor can be used as a method to decrease the tension during embarrassing situations for both students and the teacher such as when somebody makes a mistake. The tension-reducing effect of humor is confirmed also by Deneire (1995) who emphasizes the fact that the student's anxiety levels are especially high in the foreign language classroom. Not only do students have to speak in the foreign language, but they also have to do it in public.

[1] The Oxford Dictionary. Available from: < http://www.oxforddictionaries.com/definition/english/humour> [30.06.2015]

Berwald (1992), Deneire (1995) and Vizmuller (1980) also examine the possibilities of employing humor in a specifically linguistic context. Students could be made aware of differences in phonology, morphology, lexis, and syntax within or among languages. Having to work on an authentic piece of language such a humorous joke is also seen as very beneficial to the cognitive process of learning by Vizmuller (1980). Furthermore, humor seems to be a potent tool for teaching students about foreign culture and habits (Deneire, 1995).

It is, however, central to draw attention to the appropriateness of humor in respect to age and context, in order not to confuse students, especially the ones who are not concentrated enough in listening or reading. (Berwald, 1992).

1.2. Memes and image macros

Image-based memes or image macros are „photographic images on which a humorous caption or catchphrase has been digitally superimposed"[2]. Having started their spread in online forums or communities such as 4Chan or Reddit, image macros quickly left their initial virtual communities to become widely popular (Chen, 2012). The more general concept of an "Internet meme" describes the spread of content such as jokes, videos, catchphrases, melodies or images from one person to others via the Internet. The biologist Richard Dawkins is the first one to use the term "meme" defining virally spread content as "small cultural units of transmission, analogous to genes, which are spread from person to person by copying or imitation" (Dawkins, 1976). The term has later become predominantly used to refer to online content.

The importance of the meme-concept to this research paper is twofold. Firstly, it is a shared authentic social phenomenon and an example for co-creation of cultural artefacts and, secondly, the viral distribution of memes is based on the psychological process of emotional contagion. Both, as is suggested by the author of the current paper, might be relevant to language learning.

Firstly, memes are pieces of cultural information getting passed along in the micro-level, but gradually shaping the mindset and behavior of entire social groups (Knobel & Lankshear,

[2] The Oxford Dictionary. Available from: <http://www.oxforddictionaries.com/definition/english/image-macro> [30.06.2015]

2007). Nowadays, they are highly compatible with the way culture is created in the most popular platforms of the Web 2.0 era such as Facebook, YouTube or Wikipedia, primarily relying on user-generated content (Shifman, 2013). According to Conte (2000) people are the active agents behind the process of cultural transmission who shape and alter memes in addition to merely passing them on. All this happens in accordance with social norms and preferences. Shifman (2013) suggests that memes are a shared cultural experience and have three main dimensions that can be imitated in the process of co-creation: content, form and stance. Content resembles a specific text or an idea. Form is the way a message is transferred e.g. through an image or sound. And the stance presents the positions of the addresser (i.e. the person who views a particular meme) in relation to the content and social norms of the other potential co-creators (Englebertson, 2007).

The second reason why the meme-concept is important to the current research is emotional contagion which seems to be responsible for the viral distribution of Internet memes. The concept involves emotions being contagious because people seem to believe that engaging in the same actions as the others around them is the socially acceptable behavior. (Guadagno, 2013).

1.3. Applied linguistics and intercomprehension

The topic in applied linguistics that has a high importance for the current research paper is intercomprehension. Intercomprehension is defined as a form of plurilingual communication in which everyone understands the language of the others and speaks the language he knows (Kaplan, 2010). It is a rather novel approach in linguistics which is based on the similarities within and among language families such as the Romanic or Slavic languages. One of the most important principles is based on the notion of transparent and semi-transparent words sharing the same or slightly modified roots (e.g. the English “theatre” and the Spanish “teatro”) (Doyé, 2007). The intercomprehension teaching approach does not offer factual information, but strategies for the application of existing knowledge. As the linguist Eric Castagne puts it: “we must, in the first place, take advantage [of] the knowledge of our mother tongue to read in another Language” (Castagne, 2007).

The main effect of intercomprehension is achieved by motivating learners to start or continue their studies. The already existent knowledge possessed by learners might help them to understand newly encountered foreign language content which influences one's readiness for

more learning (Doyé, 2007). This is also supported by the two conditions for learner's success formulated by Heckhausen (1974) that, firstly, tasks have to be attractive and, secondly, that the goals have to be attainable.

1.4. Language learning motivation

1.4.1. Language learning motivation research

According to (Dörnyei and Ushioda, 2013: 195) "Language learning Motivation research (L2 Motivation research) is aimed at understanding the operation of motivational factors/processes in the learning of second languages as well as exploring ways to optimise student motivation". Since motivation is abstract, indirect indicators are necessary for evaluating it incl. the learner's self-reports, specific behaviours or physiological responses (e.g. change of blood pressure, sweating etc.). Traditional language learning motivation studies focused on more general aspects of motivation like socio-economic context, language attitudes and beliefs which define among others the language choice or the decision to enrol in a course. Modern motivation theories are, however, also concerned with situational factors (Dörneyi and Otto, 1998) more adequate for analysing actual learning behaviour. These executive motives are also the primary interest of the current research paper.

1.4.2. Motivation theories

There are three distinct phases of L2 motivation theory research following one another historically and taking different views on motivation conceptually (Dörnyei and Ushioda 2013: 39).

a) The social psychological period (1959-1990)
b) The cognitive-situated period (during the 1990s)
c) The process-oriented period (turn of the century)

The social psychological view on motivation assumes that learner's attitude toward the foreign language and the foreign language community or nation have a strong influence on the learning behaviour. Learners have to acquire knowledge of the language but they also have to be willing to "to identify with members of another ethnolinguistic group" (Gardner and Lambert 1972: 135) which mainly depends on the social context. One of the most prominent researchers in this period, Gardner, summarizes the three main components of foreign language motivation: motivational intensity or effort, desire to learn the language and attitudes towards learning the language (Gardner 1985).

The cognitive-situated period emphasis on a more situated analysis of motivation in specific language learning contexts (Crookes and Schmidt 1991). Dörneyi (1994a) suggested a language learning framework consisting of three distinct motivational levels: a language level (includes components related to the culture and the community), a learner level (involves individual characteristics of the learner such as self-confidence), and the learning situation level (includes situation-specific motives such as course-material, teacher personality etc.).
Similarly, Williams and Burden 1997's constructivist view of motivation combines the two premises that although each learner's motivation source is a different one, he or she is affected by the same major social and contextual influences.

During this period task-based research increased rapidly and made it possible to break down the language learning process in its constituents and to analyse the cognitive mechanisms involved in learning.

The following process-oriented period presents motivational processes as they happen in time. Williams and Burden (1997) were the first to make the important distinction between motivation for engagement (choices, reasons, wishes) and motivation during engagement (how one feels, behaves and responds during the course of learning). This central distinction plays an important role also in this current research paper since the author only concentrates on the motivation during engagement while the impulse for studying was not analysed but only controlled for.

The leading process-oriented model is created by Dörnyei and Otto (1998). Their framework organizes the motivational influences of L2 learning along a sequence of separate events from the beginning to the realization of motivated behaviour. The two dimensions of the process model are "action sequence" and "motivational influences". The former represents the behavioural process whereby initial wishes, hopes and desires are transformed into goals, then intentions, then actions, and, finally, accomplishments. The latter describes the sources of motivation and energy of the learner.

The three phases of the process are the preactional phase (in which "choice motivation" is defining), the actional phase ("executive motivation") and the post-actional phase (involves critical retrospection after action has been completed or interrupted). From major importance for this master thesis is the actional phase in which the main motivational influences are likely

to be the quality of learning experience, the sense of autonomy, rewards and goal structures, knowledge and use of self-regulatory strategies and social influences.

So, in order to do justice to the dynamic and situated complexity of the learning process further approaches emerged.

Ushioda (2009) criticizes the reductionist linear models of motivation due to their main focus on a small number of variables that can explain a significant portion of variance in learners' behaviour or performance. She concentrates on the complex individuality of real persons emphasising on the fact that for a language learner being a "language learner" is not the only aspect of one's social identity. Other identities such as e.g. being German or a mother might be more relevant at various times to the motivational process of language learning. Related to this is Legenhausen's (1999) accent on the importance for the motivation of language learners to "speak as themselves" with the real social identities they would like to express.

Another set of theories links the learner's self with their actions. Markus and Nurius (1986) proposed the theory of "possible selves" which explains how the self controls behaviour by setting goals and expectations. Dörneyui developed the concept of these "future-self-guides" into a three-component framework in his "L2 motivational self-system" consisting of:

a) The ideal L2 self (The learner would like to become a foreign language speaker).
b) The ought-to L2 self (The learner believes they have to meet others' expectations.)
c) The L2 learning experience (situation-related motives).

1.4.3. Motivation strategies

After presenting some of the main theories about the various motives behind language learning, a brief discussion on the motivation strategies and approaches in practice follows. Dörneyi (2001b) offers a comprehensive framework for motivational strategies by following through the motivational process from the onset of the motivation to the final evaluation of the learning action. The key components in this framework include:

a) Creating the basic motivational conditions (setting the scene for the effective use of motivational strategies)
b) Generating student motivation (pre-actional phase)
c) Maintaining and protecting motivation (actional phase)
d) Encouraging positive self-evaluation (post-actional phase)

In order to remain in the scope of this thesis, I will only discuss the most relevant elements of each unit which relate not only to a live classroom but also to mobile learning.

Firstly, creating a pleasant atmosphere in the classroom is a basic motivation condition. In a virtual classroom learners do not feel as exposed (e.g. to ridicule or embarrassment) if no one can actually see them (Dörneyi and Ushioda 2013: 111). Different form of anxiety might, however, arise which is caused by the constraints of technology (e.g. the pressure to respond quickly or the lack of nonverbal cues) (de los Arcos (2009)).

Secondly, one of the methods to generate initial motivation is by increasing learners' expectancy of success and their goal-orientedness (Dörneyi 2001b). Just as stated in the section about applied linguistics and intercomprehension, accenting on the attainability of the new knowledge will stimulate learners. Other ways to raise learners' expectancy of success are by offering them sufficient preparation and help and explaining clearly the meaning of success in the task in question. Goal-orientedness influences learners' performance in several different ways. To begin with, learners' efforts are directed at goal-relevant activities. Moreover, they adapt their effort levels according to the difficulty of the task. In addition, persistence is encouraged until the accomplishment of the goal.

Thirdly and most importantly for the current research, motivation in the process of learning (the actional phase) has to actively be supported because people tend to get bored of an activity, get distracted by more attractive tasks and lose sight of the goals. (Dörneyi and Ushioda, 2013: 118). The two most relevant actions in this phase that are to make learning engaging and enjoyable and to let learners set specific learner goals.

To begin with, learners have to see the meaning of learning to their own lives (McCombs and Whisler 1997: 38), so relevant teaching materials have to be carefully chosen. Learning tasks have to be varied, challenging and content has to relate to learners natural interest (Anderman and Anderman 2010). Furthermore, in the study of Ushioda (1998) comparing the factors for success of low and high proficient learners, "engaging in enjoyable and intrinsically motivating activities" was central in the strategies of more proficient learners to cope with demotivation.

As far as goal setting is concerned, setting "proximal subgoals" has a powerful motivating function since it gives learners incentives and a feeling of advancement and allows them to have a greater sense of control over their learning (Jones and Jones 2009). Goals have to be clear and as well as measurable and achievable (Locke and Latham 1990).

1.5. Vocabulary learning

Although entertainment and motivation are the focus of this research paper, some attention shall be paid to the process of vocabulary learning, because it will be the language learning field enriched with entertaining content. The following paragraphs do not pretend to be an exhaustive summary of the pedagogical factors involved in the process but only a brief overview of the most relevant ones.

The goal of vocabulary learning is memorizing the meaning, written form and sound of a word. From a cognitive point of view, the interaction of short-term and long-term memory is central for the effective memorization and retrieval of vocabulary. It should be kept in mind that the short-term memory has a limited capacity of up to about seven items that can be saved for a short time period (Miller 1956). Another three important concepts from learning research have also to be taken into consideration when developing a vocabulary learning system or methodology: the testing effect, the spacing effect and overlearning (Edge 2012).

The spacing effect occurs when learners study some content in several sessions instead of just in a single overloaded one and leads to a better remembering of the learned content. This content might include vocabulary learning (e.g. Bloom & Shuell, 1981), memorizing facts (e.g. DeRemer & D'Agostino, 1974) etc. The testing effect occurs when tests concerning studied content e.g. new vocabulary strengthen memory more that the repetition of the studied content (Carpenter and Delosh 2006). Levy & Kennedy (2005) support the principle that mobile vocabulary learners should have to make effort to remember past learning than just be passive knowledge consumers. Finally, overlearning occurs when a learner who tests their knowledge of a fact or a vocabulary learned and remembers it correctly additionally tests their knowledge of the item (Rohrer et al. 2005). Overlearning might lead to an increase of the percentage of successfully retrieved knowledge items even after longer periods after the initial tests.

All these abovementioned effects play a pivotal role in flashcard-supported vocabulary learning. Flashcards bearing some information on one or both sides and their modifications (e.g. text and image) are not a novel learning approach for repletion and exercise. Their simplicity and mobility and some of their extensions made possible only through the use of modern mobile technology are their main advantages making them widely used (Edge 2012). The 'Move, Idioms!' project enabled students to create flashcard-like artefacts consisting of real-life photos they took with their smartphones and describe with sentences containing specific Chinese idioms (Wong 2012). The project emphasized the significance of encouraging learners' habit of using objects and everyday life situations to support their learning activities and to not only rely on teacher-provided resources. Moreover, it is an example of the potential of even simple learning approaches (Wong 2012). A disadvantage of flashcards is their limited ability to present more abstract concepts which can hardly be displayed in a single picture. Later in the System design section algorithms for learning vocabulary with flashcards will be briefly discussed.

Another vocabulary learning concept of high importance for the current research is contextual learning. Learners discover the meaning of new words from context as they are used in the target language (Prince, 1996) rather than by simply learning the vocabulary with their translations. It is assumed that this improves learner's ability to apply the new words in other situations. According to Hulstijn (1992) vocabulary are better remembered due to the additional mental effort exercised when trying to decipher the meaning.

1.6. Mobility in learning

According to Pegrum (2014) mobility in learning has three possible expressions: mobile devices, mobile learners and mobile learning. Firstly, the devices are mobile, although the learners and the learning process are not. Secondly, the learners use their devices while being on the move, outside their home or classrooms (Pachler et al. 2010). The frequent periods of downtime while waiting for public transport, travelling or having a meal can be used for studying. Having in mind all the distractions and the technological affordances of mobile devices, the content has to be in small portions and the learning delivered in brief episodes which is in contrast to traditional education (Pegrum 2014). Thirdly, the learning experience itself can be mobile. Situated learning during school excursions or museum visits transforms real-world contexts into learning contexts through using Internet sources for information on the go or by sharing photos with friends (Kukulska-Hulme, 2010b). To sum up by quoting

Traxler: “while desktop technologies operate in their own little world, mobile technologies operate in the world” (Traxler 2010).

1.7. Learning theories

A brief review of the three leading learning theories follows.

Behaviorism is based on incentive-reaction chains and excludes inner psychological or social processes as an explanation for human behavior (Skinner 1938). The main learning goal is remembering of knowledge, while the type of knowledge taught mainly consists of facts. The content delivery within mobile applications for language learning continues to be predominant (Burston, 2014). The two practical reasons why this is the case are that the nature of mobile learning is episodic, in small bursts and that vocabulary and grammar repetitions and exercises are relatively easy to implement technically (Pegrum 2014.) Software systems based on behaviorism are teacher–centered or system-centered and mainly rely on operant conditioning, based on Skinner’s Reinforcement Theory, which assumes that behavior is connected to its consequences, so the implementation of rewards (punishments) leads to the increase (decrease) of a specific behavior. The process of rewarding in the software systems can have the form of badges, points etc. (Domjan 2003).

Cognitivism concentrates on the acquisition and processing of knowledge within the brain of a person (Bandura 1986, Schunk 1996: 117). An important distinction between behaviorism and cognitivism lies in their understanding of motivation: for the former, theory motivation is extrinsic, for the latter, it is intrinsic. The main learning goal is solving problems and creating a more profound understanding of concepts. Software systems based on cognitivism are often adaptive to learner’s abilities and progress (intelligent tutoring systems) and provide a rich variety of content allowing learners to discover knowledge on their own (Psotka 1986). After an analysis of user’s behavior within the system, such programs provide personalized learning units. Two important concepts to observe when devising cognitivist learning platforms are the Cognitive Load Theory (Chandler and Sweller 1991) and the Multimedia Principles of Learning (Mayer 2009). The former suggests, among other things, the exclusion of irrelevant content within a learning unit in order to not overload learner’s short term memory. The latter offers a set of principles to follow in order to achieve a more efficient learning process. Some of these are discussed in detail in the section *System design*.

Constructivism suggests that learners have to actively get involved in constructing knowledge for themselves which depends on their previous experience, knowledge and ideas. Knowledge cannot be passively transferred to individuals (Vygotsky 1978, Schunk 1996: 230). The main learning goal is provoking reflection and creativity. Learning in computer-assisted systems should be authentic and providing users with realistic complex problems, multiple perspectives and social contexts (Pegrum 2014). Moreover, systems should be flexible and allow for an individualized learning process.

1.8. Categories for mobile assisted language learning

Pegrum (2014) classifies existing mobile assisted language learning (MALLs) in four separate categories on a scale of rising activity:

a) MALL for content
b) MALL for tutorials
c) MALL for creation
d) MALL for communication

If not otherwise stated, the information in this paragraph is based on Pegrum (2014, Ch. 4).

MALL for content is dedicated to delivering various content to learners which can be consumed in a self-determined and autonomous way. Pedagogically and technically simple, this approach can provide users with authentic material and assist them e.g. with in-built dictionaries. Multimedia contents when offered in a way congruous with the Multimedia Principles of Cognitive Theory (Mayer 2009) generally increase the language learning success rate. Text with images or videos can foster vocabulary acquisition (Chun, 2006) and subtitled videos can have an additional positive effect on listening comprehension (Chang & Chang, 2013). Some caution is advised since learners' cognitive levels and memory capacities differ, so for some a media-rich learning content might lead to distractions (Chun, 2006).

Tutorial MALL adds to content MALL various exercises known from traditional classroom language learning such as grammar drills, gap texts, quizzes and others. A promising trend in this field is the development of intelligent mobile applications for language learning that provide learners with personalized feedback and recommendations that concern both the on-spot usage of the tools, and the everyday long-term learning process.

MALL for creation comes close to the theory of constructivist learning requiring individualization and teacher coaching. Examples of MALL for creation include learners producing and editing written text for blog entries or e-books, recording video of theatrical scenes in a foreign language, creating podcasts etc. In contrast to content or tutorial MALL, creation MALL is less scalable from an organizational perspective because it involves existing groups of study, usually classes and teachers. Although it is at a technical disadvantage as far as the creation of image, video and text editing is concerned, it is very well suited for creating in situ records in target language contexts which might foster the "noticing" of language (Kukulska-Hulme and Bull (2009). In addition, Ros i Solé et al. (2010, p.40) discuss that mobile devices can easily become "tools for constructing a chronicling of the self".

MALL for communication enables interaction either between learners and their teachers, peers and other language speakers, or between learners and wider audiences. Communication can aim to enable discussions, getting of feedback or exploration of opinions. Communication MALL is often closely connected with MALL for creation, but under certain circumstances it can scale, thriving on decentralized networks functioning in a peer-to-peer manner. Some mobile language learning projects have integrated features from popular social media sites such as commenting, tagging or rating which is an indication for the rising role of social media for learning. Social media platforms possessing various forms of communication modalities and means of expression have become an inseparable part of social life of a vast majority of the population – no matter if used on the desktop or on mobile smart devices. An important feature of social network platforms is the possibility to share your own or others' creations, to annotate, tag or edit them. According to Constantinides (2013) the modification of others' content might be highly creative in its interpretation and, as far as foreign languages are concerned, can be very beneficial to the learning process.

1.9. Personalization, authenticity and collaboration

Three of the most distinctive characteristics of mobile learning are personalization, authenticity and collaboration (Kearney, 2012). According to Viberg (2013) those three features of the mobile learning application in his research project are valued the highest by learners.

1.9.1. Personalization

Personalization in the e-learning context is understood as the combination or expression of broad learner choice, self-regulation and customization (McLoughlin and Lee 2008). Learners have a control over the place and time of learning and are autonomous to decide how often and what exactly to study (Kearney, 2012). According to Traxler (2007) the feeling that activities are tailor-made and the convenience to study with your own smart device increase "the sense of ownership of one's learning".

Context-awareness achieved through technological features such as GPS, time-awareness, closeness to specific objects or people via Bluetooth or Wi-Fi, also contributes to the personalization of learning. Focusing on the learner's individual experiences as a basis for learning is also an important aspect of personalization and informal learning (Dewey 1938).

1.9.2. Authenticity

Authenticity in the e-learning context is understood as the quality of content, exercises or approaches to have real-life relevance and be meaningful to the learner (Newsmann 1995). Learners work on real-world projects (Donovan 1999) that are valuable on their own and not only as an exercise or preparation for something else. Herrington (2003) presents a set of ten characteristics that define authentic learning activities including complexity of the tasks, collaboration and reflection opportunities, interdisciplinarity, diversity of possible outcomes etc. It should, however, be noted that authenticity might be subjective and depend on the perception of learners about the non-educational values of the learning practices (Barab 2000).

Two types of authentic learning environments are presented by Radinsky et al. (2001): a simulation model and a participation model. In the simulation model learning tasks only resemble reality but take place in a traditional learning space. In the participation model learning tasks are part of real work for a project or a job.

As far as m-learning is concerned, authenticity usually involves contextually-rich tasks and user-generated artefacts (Pachler, Bachmair, and Cook 2009). Examples of highly authentic activities are using twitter at a conference, augmented learning in a museum or creating blog articles on the go on a relevant topic (Kearney 2012).

1.9.3. Collaboration

Collaboration in learning is primarily involving the interaction with other learners, usually more experienced ones (Trudge 1990). Based on Vygotsky's socio-cultural psychology (Vygotsky 1978) it involves the construction of meaning through exchange of viewpoints. The main advantages of collaborative mobile applications are the facilitated communication, the connectedness to a shared network, the ability to give and receive quick feedback and the ability to interact not only through but also around the devices (Kearney 2012).

1.10. Entertainment in mobile learning

The beneficial effect of enjoyment on language learning success and motivation is evident in various scientific publications. Listening to popular English songs improved the listening skills of Taiwanese students in the research by Lee (2014). Moreover, students were able to improve their knowledge of common phrases useful for everyday communication. Furthermore, English mainstream songs are seen as a ubiquitous form of learning due to their presence in lots of media channels of which young learners are part of. Interestingly enough, less popular songs chosen by a teacher resulted in a poorer student performance, so as far as entertaining content is concerned personal opinions and preferences should be taken into consideration when designing learning tasks.

Similarly, Berk (2009) analyzes the use of video clips from TV movies or YouTube in the language classroom and summarizes the evidence that they can under certain circumstances "increase memory, comprehension, understanding, and deeper learning".

Sandberg et al. (2014) indicate that learning foreign language vocabulary with the help of a mobile application with a rich gaming context improves the results of students in post-tests. A crucial finding is also that students using the gaming application valued it more than the students in the control group who used a non-entertaining mobile application.

As Liaw's (2007) study states there might be cultural differences in the perception of entertainment in the learning process e.g. Asian students might be more concerned with the usefulness of a learning tool, while European ones might prefer a higher level of enjoyment (Liaw 2007).

2. System design

2.1. The study

This study takes as a premise that executive motivation, present in the actional phase of learning (Process-oriented model by Dörnyei and Otto, 1998) may be influenced by modifying the content to which language learners are exposed. The medium of delivery of the input in the current study is a smartphone. The researcher sought to compare the differential effect of learning a foreign language, Spanish, with entertaining visual content vs. a neutral, merely descriptive visual content. The content was distributed with modified flashcards. The independent variable was the type of content to which participants were exposed, the dependent variables were the general satisfaction with the system, the perceived improvement of the Spanish ability of the participants, the perceived motivation and enjoyment of learning with the system as well as the mean duration of usage of the system.

2.1.1. Research questions

The two questions that are addressed in the master thesis are the following ones:

1. "Do we observe an increase in learners' executive motivation when studying foreign language vocabulary with the entertaining image meme approach? "
2. "Do learners exposed to the entertaining image meme content demonstrate a higher level of reported improvement of Spanish ability?"

In addition to validating or disproving the hypothesis that authentic, humorous content has a positive effect on motivation in the actional phase of learning and learning effectiveness, exploring users perception of technical and usability features of the system was a part of the research. It has, however, had only a secondary importance.

2.2. Implications for the system design

The language learning system, Punny, is an adaptation of the visual content of the already mentioned popular entertainment platform 9GAG (and lots of its similars) to the behavioristic language learning approach with flashcards.

At first, the author of the idea and this master thesis tried to technically create the solution with a team of an iOS-programmer and a graphic designer[3]. The application had to run on iOS. Due to technical reasons and time constraints the team work was terminated and the author of this master thesis decided to create a web-based prototype of the application. There was a downgrade in the possible functionality of the application since it was also not possible to track the user behavior as efficiently.

Finding an optimal solution for the design of a new system is often not possible. The main constraints in the current case were related to the goal of testing a very specific hypothesis (entertainment and intrinsic motivation in mobile language learning), the insufficient number of test users (18 participants in the experiment), the relatively little amount of time users were ready to dedicate to the tests, the technical and time constraints of the author himself. Still, despite the various compromises a viable prototype was created.

The *Appendix A, GIBIS for System Design Decisions*, contains three GIBIS-diagrams presenting different choices for the design of the system.

2.3. Design of mobile learning applications and pedagogical success

According to Botha, et al. (2010: 30), the pedagogical success of mobile learning applications strongly depends on the factors interactivity, multimediality, task type and measurement of the learning progress. The following four paragraphs dedicated to the latter factors are partially based on Maske's (2012: 191 – 196) summaries and findings.

2.3.1. Interactivity

In the context of mobile learning interactivity defines the intensity of interaction between learners and the teacher. The teacher's role could be taken by a software system. The mediation between learner and the application thus happens through the human-computer interface which has to comply with certain requirements to achieve the desired educational effect (Botha *et al.* 2010: 30). Firstly, interactivity is closely connected to usability. Insufficient usability levels lead not only to a decreasing acceptance of the technological system, but also to a risk that the subconscious learning processes are hindered by the

[3] The programmer is Ivaylo Tsonev (ivaylo.tsonev@outlook.com), a Bachelor student at Free University of Berlin, the graphic designer is Marta Andreeva (marta_andreeva@yahoo.com), a Bachelor student at the University of Potsdam.

negative emotions towards the system (Konradt, *et al.* 2008, S. 92]. Furthermore, interactivity is related to certain didactic functions streamlining the learning process. These are among other the motivation through an interactive feedback, an adaptive presentation of content to stimulate understanding, and the ability to reach for additional content which supports knowledge transfer (Niegemann, *et al.* 2008: 295-297).

In the case of the Punny application these functions are weakly developed due to the small scope of the research. The multiple choice questions in each learning unit offer a simple feedback on the correctness of the learner's answer. The foreign language content is presented in both a textual form (translation), and a visual form (exemplification, context and emotion). Lastly, an extension which would have increased the knowledge transfer within the application, would have been an integrated dictionary which allows to access further content.

2.3.2. Multimediality

The concept of multimediality, or multimodality in the context of mobile learning human-computer interfaces, describes the combination of different media types incl. text, images, animation, video and audio (Viererbe 2010: 33-35). Examples of multimodal interfaces include graphical dialogues with textual input fields or adding graphic metaphors (e.g. question marks pointing at the help-function, arrows pointing at a drop-down menu etc.) to text-based materials. Although a multimodal presentation of learning contents leads to a better understanding and retention in general, there are combination of different medial types that can decrease success. The findings of the Cognitive Theory of Multimedia Learning offer a wide range of guidelines for achieving an optimal media mix (Mayer 2009).

The main principles from cognitive theory that are followed in the Punny application are the Spatial Contiguity Principle, suggesting that educational pictures and text should be placed near each other to achieve optimal retention, the Temporal Contiguity Principle, suggesting that educational pictures and text should be presented at the same time to achieve optimal retention, and the Multimedia Principle, suggesting that the combination of words and images is preferable to text alone (Mayer 2009).

2.3.3. Task types

Generally, most task types at the disposal of mobile learning applications, also present in desktop e-learning programs, are related to the standard graphically oriented operating

systems. Tasks include multiple choice questions, gap texts or textual input fields (Maske 2012: 193). Additional tasks vary from solving algebra problems and group discussions to educational games and augmented reality tasks (Maske 2012: 194).

Different task types fit into the fields of different learning theories. Behavioristic learning models focus on rather passive task types such as multiple choice questions, gap texts or free text forms. Cognitivism prefers multimedial tasks addressing more of the perception channels of users including not only free text forms but also audio exercise and visual stimuli. Furthermore, constructivism, which is of a lower importance in this research, uses problem-solving and productive tasks such as communication-based exercises, games, augmented reality problems etc. (Reinmann 2011: 8).

The approach in the Punny application is a mix of a behavioristic multiple choice task and a cognitivist enrichment with visual and audio contents passively received by the learner.

2.3.4. Measurement of the learning progress

The insights gained through measuring and evaluating learners‘ progress and results can be used to assess the quality of the learning process and the teaching effectiveness (Maske 2012: 195). The learning success depends on the learning model chosen for analysis. Behavioristic learning concepts define success as the successful retention of different facts. Cognitivism provides an indirect way to measure learning success by observing learners’ ability to adapt problem solving methods to new situations (Maske 2012: 196). Constructivist learning approaches focus on the assessment of argumentations, background knowledge and complex solutions. Mostly, a human teacher is needed to execute these assessments in the latter case, so a full automation of the assessment is not possible (Maske 2012: 196).

Due to time constraints and technical reasons no system for measurement of the learning progress was implemented in the Punny application.

2.4. Overview and technical implementation

The Punny application for language learning supports three functionalities:

a) visualizing foreign words and phrases by means of image and text, with pictures slightly resembling flashcards,

b) testing the user's translation capability with multiple choice questions with possible translations in the mother tongue (English is set to be the mother tongue here).
c) providing users with a sound overlay in the foreign language (Spanish as foreign language).

There is only one mode of usage displaying a vertical timeline of pictures, each one presenting new content or repeating an old one for better memorization. By scrolling down users arrive at the new images.

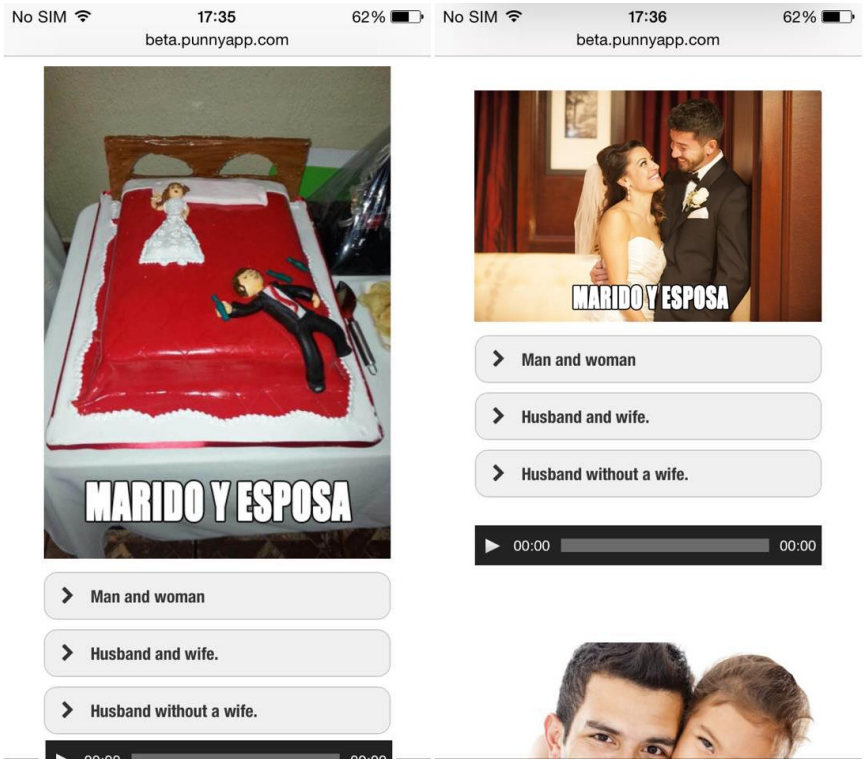

Fig. 1. Comparison of entertaining image-meme and neutral image.

The prototype used for the experiment in this paper is a responsive website optimized for smartphone usage that could be found under the domain http://beta.punnyapp.com/. It is built on the Wordpress platform, an open-source content management system with about 19 % of the world's websites running on top of it (O'Dell 2013).

The frontend of the website was provided by the free responsive theme Responsive II (Responsive Mobile, computer software 2015) created by CyberChimps (CyberChimps, computer software 2014). It provides the users with a very minimalistic design not distracting from the main content of the website. The template is responsive and needs no additional

adaption for specific devices. It ran flawlessly on all devices on which the prototype was tested before being presented to the participants in the experiment. These included an iPhone 5c and a Samsung Galaxy S3. The entire backend of the website was automatically created with the installation of the wordpress-content management system. It is based on the server-side language PHP and the database language MySQL.

The content, consisting of textual, visual and audio files, was uploaded manually to the server and integrated on the website. There were about 150 image files (ca. 75 in both the control and experimental group) and 60 audio files (one for each unique phrase). The content was arranged by modifying html source code. The plugin that was used for enabling the multiple choice functionality was Shotcodes Ultimate for WP, a solution by the web developer Vladimir Anokhin (Shortcodes Ultimate, computer software 2015).

2.4.1. Structure of single unit

A single unit of content consists of

a) an image;
b) a word or a short phrase in the foreign language placed in its lower or upper side;
c) a multiple choice question suggesting three possible translations of the phrase on the picture, with a hidden feedback window popping out as soon as someone makes a choice, and
d) a single audio-file with the pronunciation of the phrase.

The image has an entertaining content which is predominantly humorous or in some way surprising and causes positive emotional reactions. In contrast to the benchmark case in which the images have a neutral context such as in most wide spread language learning application (Babbel or Duolingo), the pictures in the Punny application offer authentic contents.

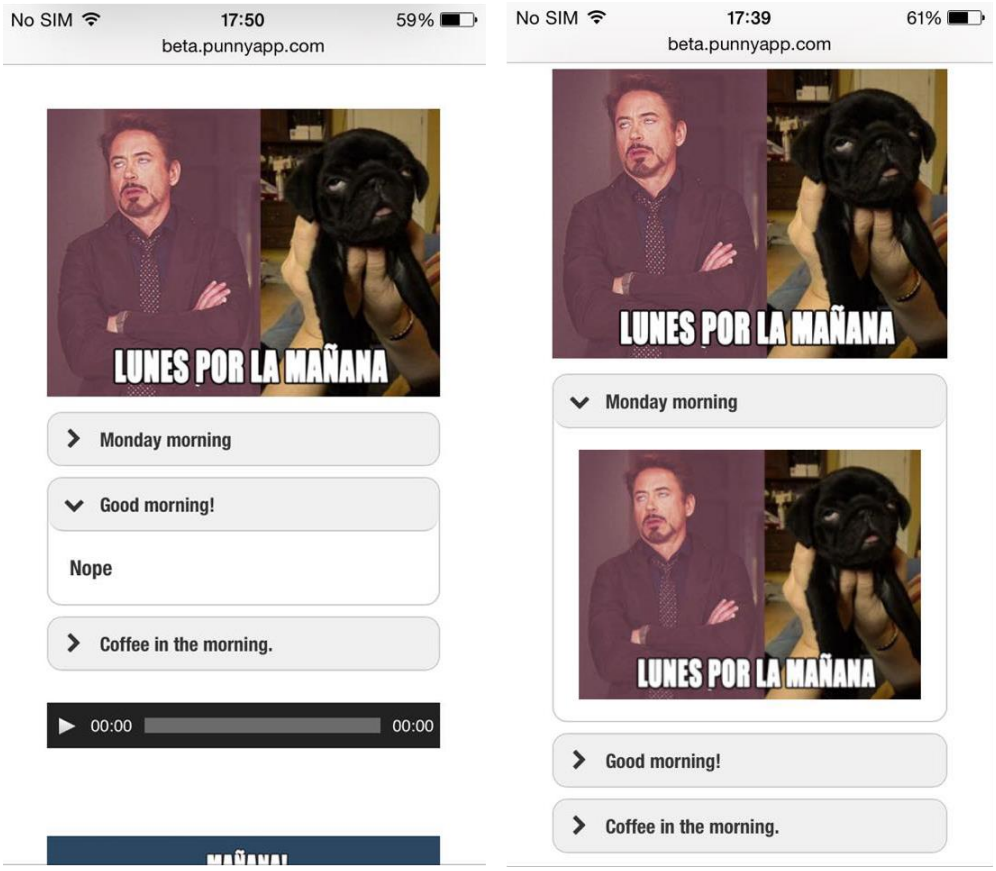

Fig. 2. Comparison of the feedback for a wrong and a correct answer.

The images have been collected from the platforms of 9GAG (9gag.com) and Flickr (flickr.com), one of the biggest photographic communities and databases in the world, all of them provided to the public domain by private users. The selection of the images was subjective but guided by the leading theories for humor presented in the *Literature Review* (Buijzen, 2004). The editing of the pictures with Photoshop included adding a specific text suitable to each picture and a resizing. The font chosen for the text is called Impact (designed by Geoffrey Lee in 1965) and is recently widely used for popular image macros. The audio recordings in the foreign language were downloaded from Google Translate, the popular automated translation tool offered by the multinational technology company Google (translate.google.com/).

2.5. Usability and design principles

Although the scope and the functionality of the application are rather small, usability was still an important issue when developing the system. One of the reasons was minimizing the risk of unexpected dissatisfaction with the application due to some usability-failure. A mistake might have led to a serious bias when trying to analyze user acceptance of the system. A

special attention was also paid to differences in usage which might have occurred due to systems with different technical capabilities e.g. a smartphone being more powerful than another one.

The design principles which were followed stem from Alan Dix (Dix 2009), a leading human computer interaction expert. The three top concepts in his framework are learnability, flexibility and robustness. Below, a brief overview of the system's affordances will be presented with an explanation why particular choices have been made in accordance with the design principles.

Firstly, as far as learnability is concerned, the users were exposed to the standard scenario where one has to scroll down in order to arrive at new image content. Familiarity and predictability were also ensured by integrating small arrow signs, suggesting clicking behavior, on the multiple choice questions and, additionally, and traditional sound players for the voice. All image-multiple choice units behaved consistently.

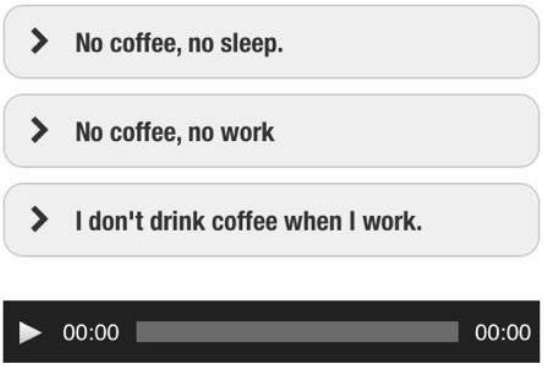

Fig. 3. Familiarity and predictability exemplified.

Due to the small scope of the system's functionality, flexibility was less of a topic when designing the application. The prototype is concentrated primarily on output of information. The simple global structure of the system attempts at gradually leading the user from one set of image-phrase units (combined in a total of four sections) to the next one. The global structure consists of a single 4-section menu. As far as user movement within the application is concerned, substitutivity is made possible with the main menu, the introduction of breadcrumbs, and the "Next section" hyperlinks in the footer of each and every section. Users can move back and forth with little effort. Multi-threading, i.e. concurrent execution of tasks,

was possible due to the ability of users to simultaneously observe an image, choose a translation and listen to the audio output.

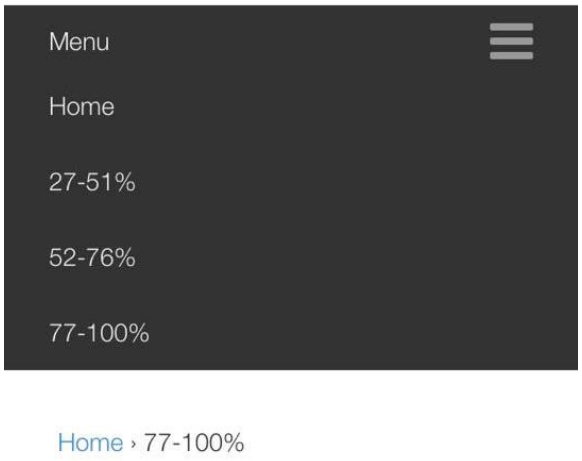

Fig. 4. Main menu and "breadcrumbs" for orientation of the system users.

Robustness, defined as the level of support provided to the user in determining successful achievement of goal-oriented behavior, was related to two goals:

a) to a user's advance to the next image-phrase units and sections, and
b) to the user's choice of the right translation to each foreign language phrase within a multiple choice question.

Concerning the former goal, a special attention was paid to the observability, giving a clear feedback to the user that he or she is progressing within the system. Each section had a title indicating the percentage of the total number of image-phrase units passed and remaining. Moreover, image-phrase units were grouped in small sets unified by a general topic (e.g. greetings) which additionally helped users to perceive their progress. Observability in relation to the second goal, choosing the right option in the multiple choice questions, was made possible through a local drop down menu giving an instant feedback whether the translation was correct or not. A wrong answer was followed by a simple "No"-response, a correct one was followed by the display of a smaller version of the picture. In terms of recoverability, the user could always correct their choice of the correct translation, move to previous content or re-listen the audio.

Some special attention had to be paid to the size of images. Both the comparatively low power of smartphone devices, and the limits of Internet broadband required a reduction of image size. In order not to decrease the subjectively perceived image quality too much, most images were

in the range between 100 - 150kB with approximate dimension of 350-600 pixels. Reducing image size was also important to ensure easy comparability between the results from experiment participants with different smartphone devices.

2.6. Rudimentary gamification

The widely accepted definition of "gamification" is that it is "the use of game design elements in non-game contexts" (Deterding 2011). Game design elements include badges, levels, leaderboards, clear goals, time constraints and limited resources. The reason why the approach is used in non-gaming situations, products and services it to increase user's engagement (Hamari 2014). Hamari's review from 2014 indicates that gamification indeed has a positive effect on engagement in certain contexts. Although the topic is not in the center of this research paper, two elements of the Punny application could be seen as rudimentary gamification features. Firstly, the phrase-image units were divided into four different sections and the title of each section stated the percentage progress each learner has made until that point. This detail has a simple feedback function to inform users that they are moving on and the end of the experiment is near. In addition, it introduces the idea of reaching the goal of having worked through all 100% of the phrase-image units stimulating the users to continue scrolling and studying the phrases.

The second feature aiming to increase engagement is the playfulness of guessing the correct meaning of a previously unknown foreign language phrase. Similar to a puzzle solving tasks learners have to find out the meaning by a having at their disposal only a limited amount of information: the image context, three possible translations and some background knowledge of similar words in their native language (see the section *Literature Review* and *intercomprehension*).

2.7. Algorithms for learning

As far as the flashcard approach of learning foreign vocabulary is concerned, there are various algorithms of defining when and how often to repeat certain words within a vocabulary drill.
One of the most widely used approaches is the Pimsleur System, primary used for audio language learning (Pimsleur 1967). Repetition of learning items happens in a progressive series of exponentially expanding intervals (repetitions after 5 seconds, 25 seconds, ~ 2 minutes, ~ 10 minutes) both within and (roughly) across lessons. On the one hand, by overlearning learners feel more confident and start to immediately use the language. On the

other hand, there is no adaptation to user feedback and periods of free time as long as the lessons must be available.

Similar to the Pimsleur system, the Leitner System is also based on spaced repetition and used for physical flashcards (Edge 2012). The system introduces different piles containing flashcards of increasing memory strength and increasing between-study intervals. If correct, cards are moved one pile up, otherwise, they stay in their current pile for relearning. On the plus side, this algorithm leads to a more frequent review of difficult items. However, it does not suggest how to deal with the huge and unmanageable amounts of flashcards placed constantly in the review piles.

Other popular algorithms include the SuperMemo algorithm which targets a fixed retention rate (Wozniak 1994) and the Fact and Concept Training system trying to predict the best items to test at any point in time (Pavlik et al. 2007).

For the sake of brevity and due to technical reasons, only two simplistic models were implemented in the Punny application. Firstly, after a target word has been introduced within one phrase and image, this same word might be used after 2 or 3 further unrelated phrase-image pairs in a different word group and a different context. Alternatively, the second appearance of the word might be within the same word group but with a different image and context. An example follows. The phrase in Spansh “Lunes por la mañana” (“Monday morning”) introduces the word “mañana” (“morning”). Several image-phrase units later, the phrase” ¡Buenos noches, hasta mañana!” (“Good night, see you in the morning!”) repeats the target word “morning” in a different phrase and a different context.

2.8. Proposed extensions not made due to technical reasons

There were several additional functions of the Punny application that were planned for implementation, but were not included in the final version of the application due to time- and technical constraints. These functions include

a) a sharing functionality allowing sending of a phrase-image unit to a friend via email or social media,
b) a dictionary and a search functionality allowing high personalization of the application by the discovery of words that are of high interest for certain users, and
c) a function to save preferred phrase-image units for later review.

The researcher believes that although the inclusion of these features would increase learners' success, their absence does not necessarily harm the validity of the findings of the experimental research. The Final Evaluation Survey includes several items to discover more about participants' preferences regarding some of the features.

3. Methodology

An experimental design was used for testing the aforementioned hypothesis (see *System Design*). It consisted of the treatment, an exposure to entertaining visual and textual content, and an evaluation survey collecting participants' opinions on the system and the learning approach. The control group used the same application which, however, contained neutral content. It was administered the same final evaluation survey.

Due to the nature of the experiment a special attention was paid to the background of participants, the comparability of the treatment and the control group and the possible biases to external and internal validity. In the *Results* section an analysis of the threats to validity is given.

A comparative study containing pre- and post-tests measuring the learning success of participants in terms of new vocabulary acquired was not appropriate for two important reasons. Firstly, the scope of the current research makes controlling for a number of external factors unmanageable (Sharples, 2009). Secondly, bearing in mind that the relationship between motivation and achievement depends on the specific learning context and a direct link cannot be assumed (Guilloteaux, 2008).

The author believes that the experiment is the proper decision for accepting or rejecting the hypothesis that entertaining content will lead to a higher learning motivation in the mobile learning context. For this reason behavioural measures and self-reports have been selected as criteria. These include, as presented in the *System Design*, the general satisfaction with the system, the perceived improvement of the Spanish ability of the participants, the perceived motivation and enjoyment thanks to the system as well as the mean duration of usage of the system.

3.1. Research design

As already presented in the *Literature Review* "motivation" is a broad topic and its research needs to carefully focus on the aspects which fit correctly in the specific context. Dörnyei and Ushioda (2013: 199) propose three steps to choose the relevant motivational aspects to target which were followed by the author of the current paper: defining the target behavioural domain, listing all possible motivational influences, setting priorities among the latter.

Firstly, target behavioural domain is defined to contain "memorizing new vocabulary". Both due to the scope of the research paper, and due to the capability of the Punny application, setting a broader target domain will not lead to clear results.

Secondly, the possible motivational influences on the behaviour, that is likely to take place during the usage of the Punny application, include internal factors such as arousal of curiosity, intrinsic value attributed to the activity, attitude to language learning in general, but also external factors such as the desire to please the researcher and the learning environment which might differ in terms of comfort, time of day, place etc. (Dörnyei and Ushioda, 2013: 52-54)). Other factors such as feelings of competence, self-worth or influence by parents and teachers are not relevant in the context of the experiment.

Thirdly, the most relevant motivational influences seem to be the intrinsic value attributed to the activity which could be understood as an enjoyment-factor due to the entertaining nature of the visual content in the Punny application. Participants are by design of the experiment and choice of the participants no language learners of Spanish (except for two participants), so the research can completely focus on their behaviour during the task of working through the phrase-image units in the Punny application and the analysis of the effects of the varying content on their motivation. A further strong motivational influence is the desire to please the researcher. Since participants voluntarily responded to the call of the researcher as their friend, their external motivation is likely to be strongly connected with their human relation.

The survey is conducted in one particular point in time not claiming to assess motivational effects beyond the scope of the mentioned contextual influence of the learning content.

3.2. Questionnaire survey

The current study mainly relies on a survey describing the attitudes and opinions of the participants toward the application Punny and the proposed language learning approach.

Questionnaires are one of most frequently used tools in motivation research (Dörneyui and Ushioda, 2013: 213). Special attention was paid to developing the rights questions, ordering them in the survey, preparing the instructions and distributing it to the test subjects.

Since the answers to the questionnaire represent subjective self-reports, biases should be considered. There might be differences between what learners say they have done and what they did. Moreover, self-reports cannot provide detailed description of participants' activities that take place in different contexts (Robson, 2002).

3.3. Log files and Google analytics

To ensure some comparability and assess the validity and accuracy of the answers in the survey, log files acquired from the Google Analytics website monitoring software which runs as a plugin on the web-based application were also taken into consideration. The software tracks some parts of user's behaviour on the website and records information such as duration of a session in the website, device with which the website was accessed and mobile carrier of the user's phone.

3.4. *Participants (demographics, contact, procedure if contacting them)*

Data was collected by means of two questionnaires, one with personal data such as age and gender and one based on a Technology Acceptance Model questionnaire as a Final Evaluation Survey. Moreover, some information was collected with the help of Google Analytics used for tracking user's behaviour within a web-page or mobile web app. The survey questions, the answers and the Google Analytics data can be found in the *Appendix B, Participant surveys* and *Appendix G, Google Analytics results*.

Half of the participants in the experimental study, the treatment group, were administered a special instructional treatment consisting of humorous pictures exemplifying some vocabulary. The other half, the control group, received approximately the same set of vocabulary but exemplified by neutral images that merely display the meaning of the vocabulary in a direct way.

The participants in the experiment were found through opportunity sampling, by addressing the personal contacts of the researcher. A Facebook post in English was firstly published calling for volunteers to support the author with participating in a language learning

experiment for his master thesis. The next three steps of interaction with the test participants were as follows.

Firstly, the volunteers were separated randomly with the help of the Microsoft Office programme Excel and its RAND function in two separate groups, a control group and a treatment group. The next steps were the same for both the experimental, and the control group. The timing of participation in the experiment was different: the treatment group started its participation on June 2 and finished it on June 9, while the control group started its participation on June 6 and ended it on June 12. Secondly, each group received an e-mail in English containing the Participant Background Survey with demographic questions and questions related to the previous experience with general or mobile language learning. Thirdly, a short message was sent to the phone numbers of the participant. This SMS contained brief instructions about using the application and a hyperlink to the web-address of the prototype. Fourthly, after two days of usage (04.06 – 06.06 for the treatment group and 10.06 – 12.06 for the control group) a second and final e-mail with the Final Evaluation Survey was sent to the participants.

The Participant Background Survey included six questions about the contact information and the demographic situation of participants, four questions about their mobile language learning experience, five inquired about participants' language learning background and their current activities with foreign languages. A final question asked about users' reasons to take part in the survey.

The Final Evaluation Survey included 21 statements about participants' acceptance of the system and their subjective assessment of its effect on their learning and motivation. Most statements were evaluated on a 5-point Likert scale, one was an open question, one controlled whether participants have an experience with entertainment platforms such as 9GAG.

For methodological reasons the control and the treatment groups were kept apart as far as possible and to the knowledge of the researcher there were no contacts between them during the duration of the experiment. The purpose of the study was to observe possible differences in the acceptance and usage of the language learning system; communication between participants from the two groups about the system would make it hard to recognize effects caused by the entertaining content to which half of the participants were exposed to.

3.5. Learning themes and target words

The target words to which all participants were exposed were about 60 of the most frequently used Spanish words that were taken from an online corpus (see *Appendix E, The most frequent 100 Spanish words*). The two main reasons for making this choice were, firstly, the attempt to reduce any biases which might arise due to participants variable interests in one topic or another and, secondly, the higher effectiveness of learning the vocabulary. The former reason has a large importance due to the desire to isolate the authenticity effect caused specifically by the humorous content and not e.g. by the fact that some learners might prefer economic topics and others sport-related ones. The second reason is scientifically explained by the concept of the *natural order* in which the vocabulary of a language that is being learned is highly correlated with word frequency. It suggests that being exposed to language in order of frequency is optimal in terms of learning effectiveness (Cohen, 1990).

Examples for target words are time ("tiempo"), year (año), way ("el camino"), game ("juego"). The phrases which put the target words in context were brief and related to the image. Examples for such phrase are "Men in black" ("Hombres de negro"), "Monday morning" ("Lunes por la mañana") and "World peace" ("La paz mundial"). Phrases and words corresponded to the context of the images in both the treatment, and the control group.

4. Results

4.1. Participants and validity

From the initial 28 volunteers only 22 filled-out the participant background survey, 18 participated until the end of the experiment which was marked by the filling-out of the Final Evaluation Form. By coincidence, the number of users who without notice ceased their participation in the experiment was the same in both the treatment, and the control group.

Before presenting the descriptive and inferential analysis of the data collected through the survey distributed to the users and validated with some data from the Google Analytics Software, a few external and internal validity considerations and results will be discussed.

There are several reasons why external and internal validity and possible sample biases are especially important in the current research. Firstly, language learning per se is a long-term

endeavour dependant not only on study-related processes such as perseverance or activity-type, but also on a wide range of external factors such as other languages studied or language family of the native language of the learner. Secondly, the size of the sample n=18 is rather small which requires special attention as far as unexpected variance or normality-assumptions about the distribution are concerned. Thirdly, due to limited resources but also due to the nature of the experiment (users working with the language learning application Punny in their normal life) participants could not be monitored closely.

4.1.1. External validity

External Validity is present if the inferences about cause-effect relationships from a scientific study could be generalized form its unique settings and participants to other populations and conditions (Mitchell 2001).

There are three threats to the external validity of this experiment's findings which need special attention. To begin with, there is a potential problem with the selection bias. All the participants in the experiment had an academic background, were either still university students, or have recently finished their degree. 15 of the 18 participants were with Bulgarian nationality, 13 of these are living abroad. The average age amounted to 23.36 years. To sum up, this young, mobile and educated group is not representative for the general population. Since the specific research topic is executive, actional motivation and entertainment in the learning process, intelligence, ambition or education have a lower importance. A special attention should be paid to age: it is expected that a more traditional, probably older, population would have a different perception of the funny and sometimes provocative content of the language learning application in the treatment group.

Another threat to external validity is posed by situation-specific factors such as the time and place of the experiment. Participants were at different places and had the freedom to use the application at various time of the days within the two days test period. The researcher had no possibility to monitor closely their actions. On the plus side, this resembles the real-life situation in which users would also independently use a language learning software on their own smartphone devices.

Finally, one should have a certain level of reactivity in mind, in particular, the Hawthorne effect (McCarbey et al. 2007). Knowing that they are taking part in an experiment,

participants are using the application only because they have to and their answers in the final survey might be influenced by this fact. This should, however, be equally true for both the treatment, and the control group, which would not harm the external validity of any findings.

4.1.2. Internal validity

Internal validity is present if a causal relation between two variables is correctly proven (Brewer 2000).

There are three relevant reasons why internal validity might be harmed in the current research. Firstly, the variation in the motivation of users to study a foreign language with the application as a dependent variable might be attributed to another factor different from the learning content (entertaining or not). This issue is called confounding (Pearl 2000). Among the suspected variables that might have an effect on motivation are the previous knowledge of entertainment platforms such as 9GAG which have a similar content as the one in the treatment group, a smartphone with better performance or the fact that participant is currently studying a foreign language. Since no significant difference between the number of participants displaying a varying characteristic in each of the two groups tested was found, one can assume that confounding was not an issue in this research.

Secondly, having in mind the lack of complete monitoring on participant's activity, there was a risk of diffusion of effects from the treatment group to the control group (Brewer 2000). As already stated in the *Methodology* section, participants did not know that there are two different sample groups and were not aware of the particular goal of the experiment.

The last threat to internal validity, was the experimenter bias (Barber 1968). Knowing of this possible effect in advance, the author of this research paper has taken special measures to not treat participants in the treatment or the control group in a different way. These measures include using the same standardized instructions distributed per e-Mail or SMS for both groups and limiting any other communication with the participants during the experiment.

To conclude, since in this research paper only the executive, actional motivation is analysed, both internal, and external validity is present and the overall tendencies of participants' opinions could be taken as a good approximation of a more general population. Due to the

small sample size, however, the absolute values of the different survey questions could hardly be extrapolated to the general population. Additionally, cultural and age factors related to the attitude towards education and humour might have an influence on how entertainment in the learning context is experienced which could be tested in further empirical studies.

4.2. Data preprocessing

Having used Google Forms for collecting participants' responses in the Participant's Background Survey and the Final Evaluation Survey, a few data preprocessing steps were taken for data transformation and reduction. Firstly, data was encoded, so that each self-report question expressing the agreement of disagreement of a user from "Strongly disagree" to "Strongly agree" was on a 5-point Likert scale, a higher number value corresponding to a higher agreement. Secondly, several variables were combined according to their more general context and meaning. Table 1 below offers an overview of the relations between the general category and the survey items. The encoding for the variables used in the statistical analysis software R is given in square brackets after the name of the general category.

Table 1

Dependent variables and Final Evaluation Survey items they contain

General category	Final Evaluation Survey items
Perceived Improvement of Language Skills [improvement]	Using the Punny app improves my Spanish vocabulary set. In general, I think the Punny app is a useful tool for language learning.
General acceptance [generalLiking]	I would use the Punny app for studying another foreign language (different from Spanish). Using the Punny app I am willing to engage in further Spanish learning activities. I like using the Punny app for studying vocabulary.
Enjoyment and Motivation [enjoyment]	I find the learning approach of the Punny app very entertaining. I enjoy guessing the meaning of Spanish phrases from different options without having previously studied Spanish. Placing every single Spanish word or phrase in a specific context by using images is central to my motivation to use the Punny app.
Importance of Place and Time Flexibility for the Learning Success [flexibility]	I feel that studying at different places is very important for my learning success when using Punny. I feel that studying at various times of the day is very important for my learning success when using Punny.

Additional functionality of the application	I sometimes wish I could also add my own images in the application. I find sharing some of the images and phrases with friends of mine might be helpful for learning the language. Saving a foreign phrase for later repetition might be helpful.
Control question for Experience with Entertainment Platforms [usage9gag]	Have you ever used the entertainment platform 9GAG (or its similar ones)?
Positive Effect of Image Content on Learning [imageRole]	I find new words are easier to remember thanks to the image content. Being distracted by the images used in the Punny app hinders my learning progress. What was the decisive factor for your success at learning new Spanish words? [The image]
Importance of Rudimentary Gamification for Learner's Motivation [gamification]	Seeing my progress with the completion of tasks is very important for my motivation to continue using the Punny app.
Perceived Difficulty of Vocabulary [difficulty]	How hard was it for you to guess the meaning of the Spanish phrases?

Special attention was paid to some of the information from the Participant Background Survey including: the language background of the participants; whether they study a foreign language now or plan to do so in the near future; whether they study Spanish or plan to do so; whether they are satisfied with the performance of their smartphone devices; whether they have an experience with mobile language learning applications. All of these variables were 0-1 coded in order to easily control for their possible effect on the dependent variables. Some reduction of information took place in the case of the current and intended language learning: the collected data about specific languages was analyzed only in terms of the presence or absence of studying of a foreign language, and not in terms of which languages the participants indicated.

A dummy variable for the belonging of each participant in the experiment to either the treatment, or the control group was added. Moreover, a dummy variable indicating whether a participant has gone through all the image-phrase units in the language learning application Punny was added. The source of the information was a single Google Form question at the end of the last image-phrase section of the application where users were invited to fill in their

names. Still, there were participants who finished all image-sections but did not filled out their name.

4.3. Descriptive statistical analysis

The mean age of the participants in the treatment group was 22.8 and in the control group 23.4. There were 4 female and 5 male participant in the former, and 3 female and 6 male participants in the latter group. The treatment group had two non-Bulgarian participants whereas the control group one. In every other aspect, as can be seen from the table below, both groups seem comparable. The number of participants who have used the 9GAG entertainment platform in the past is slightly higher in the treatment group. The satisfaction with the personal smartphone device was slightly higher in the treatment group (4.11 to 3.78).

Table 2

Number of participants in each group having a specific feature.

	Control Group	Treatment Group
User of 9GAG	5	8
Studies a foreign language now	5	5
Plans to study a foreign language in the near future	4	3
Studies Spanish or plans to study it	2	2
Has mobile language learning experience	6	6
Finished all image-phrase units	6	5

The differences between the values for means and standard deviations of the independent variables, collected with the Final Evaluation Survey are listed in the table below. Notable differences from a descriptive point of view can be observed in the means for

a) the Perceived improvement of Spanish language capability: 4.28 (treatment group) to 3.78 (control group);
b) the Positive effect of the image on the language learning success: 3.83 (treatment group) to 3.15 (control group), and
c) the perceived motivational gain from the Rudimentary gamification: 4 (treatment group) to 4.78 (control group).

Table 3

Average means and standard deviations of the dependent variables in each group in comparison.

	Mean (Treatment)	Mean (Control)	Standard Deviation (Treatment)	Standard Deviation (Control)
Perceived improvement	4,28	3,78	0,51	0,44
General Acceptance	3,85	4,07	0,34	0,46
Place and time flexibility	3,5	3,94	0,97	0,63
Motivation and enjoyment	4,37	4,07	0,45	0,28
Positive effect of image	3,83	3,15	0,65	0,96
Rudimentary gamification	4	4,78	0,5	0,44
Difficulty	3,65	3,41	0,56	0,93

The two notable values that could be extracted from the Google Analytics Report for the periods of usage of the web-based application Punny were the Number of Pages per Session and the Average Session Duration. A "Session" is defined as "a group of interactions that take place on your website within a given time frame. For example a single session can contain multiple screen or page views, events, social interactions, and ecommerce transactions."[4]. In the context of the Punny application the number of sessions shows the number of times all users have visited and used the website. A Page in the context of the application is one of the four sections each containing about 25% of all image-phrase units. The average session duration in the treatment group amounts to 632.58 seconds (10 minutes 32 seconds), whereas the duration in the control group was 260.74 seconds (4 minutes 20 seconds). The number of pages per session is slightly higher in the treatment group (3.79 to 3.49). The standard deviation of the pages per session values was with 1.038 in the treatment group less than half the value for the control group: 2.33.

A close look at the histograms of all dependent variables reveals some information about the distribution of data. The data presented is not divided in control and treatment group here. The responses of all participants for all variables lie in the interval between 2.5 and 5, so data has a negative skew. In the histogram for the Positive Effect of the Image on the learning process there are two outliers to the left, participants have selected significantly lower answers than the rest.

[4] Google Analytics Support 2014. Available from: <support.google.com/analytics/answer/2731565?hl=en> [20.06.2015]

Furthermore, without splitting the data in the two separate groups, one observes that the histograms about the Perceived Improvement, the General Acceptance of the system and the Difficulty of the vocabulary learned display unimodal distributions, resembling slightly the normal distribution around the respective means. The distributions of data in the histograms for Importance of Place and Time Flexibility for the Learning Success (modes at 3 – 3.5 and 4.5 – 5), the Positive Effect of Image Content on Learning (modes at 3 – 3.5 and 4 – 4.5) and the Importance of Rudimentary Gamification (modes at 3.5 – 4 and 4.5 – 5) resemble bimodal distributions. The frequency of values in the Motivation and Enjoyment histogram is approximately equal for the values between 3.5 and 5.

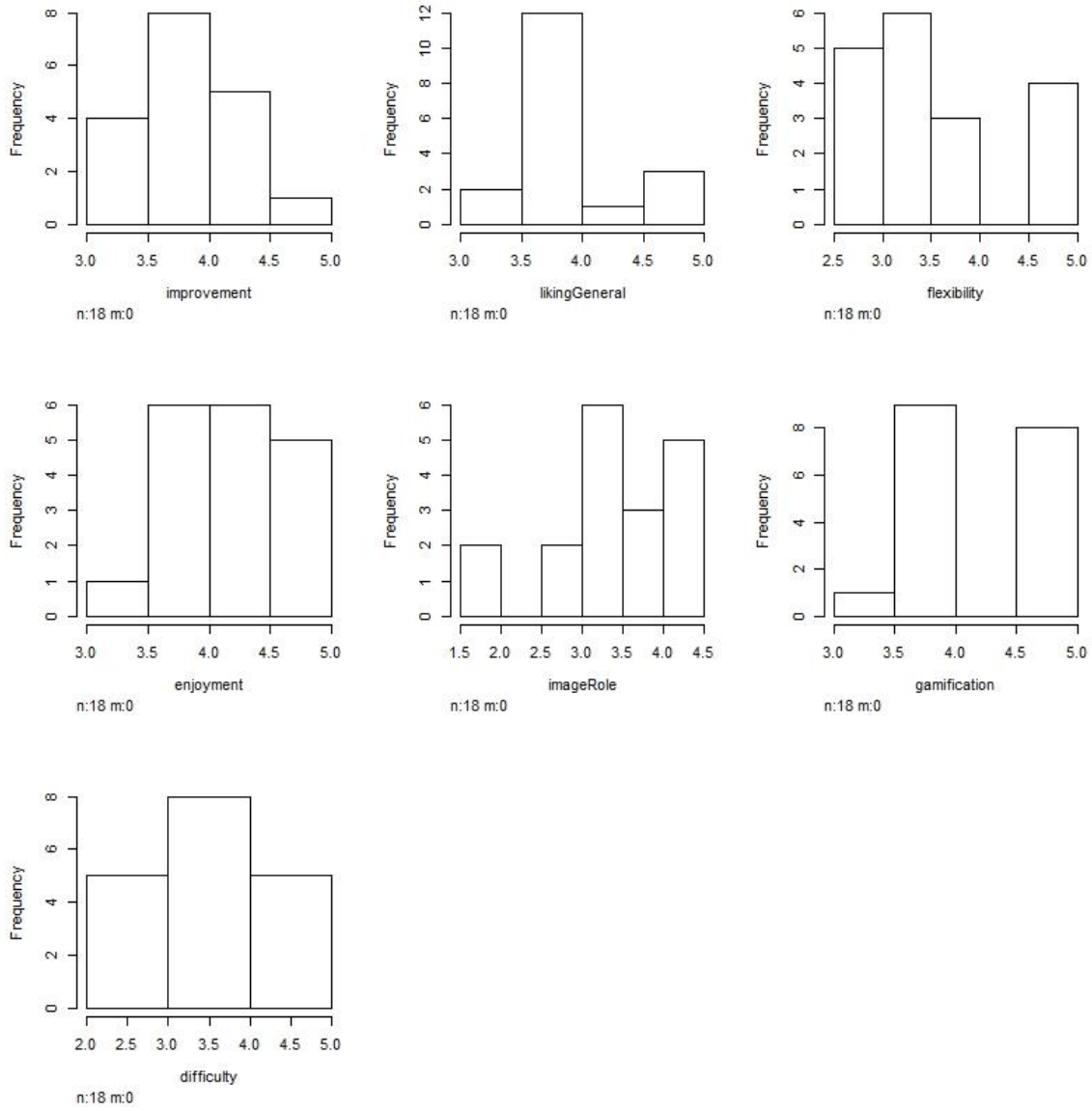

Table 4

Histograms of the dependent variables (not divided in treatment and control group).

4.4. Inferential statistical analysis

In this section statistical hypotheses about the properties of the treatment and the control group are tested, with the aim to draw conclusions about the general population and the effect of entertaining content on the executive, actional motivation.

4.4.1. Shapiro–Wilk test of normality

The Shapiro–Wilk test is a test of normality in statistics (Shapiro and Wilk, 1965). Here, it is used to check whether the values of the participants' responses come from a normally distributed population. The null-hypothesis is that the population is normally distributed. What was previously discussed in the brief analysis of the histograms will be tested in a more rigorous statistical way. Confirming of the findings from above, there is statistical evidence against normality in the distribution of all variables except for Importance of Place and Time Flexibility and Perceived Difficulty. The Null-Hypotheses of Normality is rejected for an alpha level at 0.05 for all other variables.

Table 5

Results of Shapiro-Wilk test of normality.

	p-Value of Shapiro-Wilk test
Perceived improvement	0,0449
General Acceptance	0,0449
Place and time flexibility	0,0787
Motivation and enjoyment	0,0032
Positive effect of image	0,0415
Rudimentary gamification	0,0012
Difficulty	0,0548

4.4.2. Paired difference tests

In this section three location tests will be used to compare the values of responses on the treatment and the control group to assess whether their population means differ.

Wilcoxon Signed-Rank Test

The Wilcoxon signed-rank test is a paired difference test to compare the population mean ranks of data that is not necessarily normally distributed (Wilcoxon, 1964). According to this

test there is a significant difference only between the means of the groups for the Importance of Rudimentary Gamification. The Null Hypothesis for equal means holds for all other variables at the alpha level of 0.05.

Table 6

Results of Wilcoxon Signed-Rank Test.

	p-Value of Wilcoxon Signed-Rank Test
Perceived improvement	0.1
General Acceptance	0.08
Place and time flexibility	0.44
Motivation and enjoyment	0.18
Positive effect of image	0.17
Rudimentary gamification	0.03
Difficulty	0.93

Student's *t*-tests

The Student's t-test is also a two-sample location test of the null hypothesis such that the means of two populations are equal. It assumes that variances of the two populations are equal and that data is identically and independently normally distributed (iid) (Rice, 2006).

Since there are only 18 observations, the Central Limit Theorem does not hold, so the approximation of an asymptotic normal distribution is not statistically correct under the current conditions (Rice, 2006). Still, for the sake of comprehensiveness of the analysis, it is assumed that the observations in both the treatment, and the control group are iid normally distributed and have equal variances. At the 0.05 significance level only the group means for the Perceived Improvement and the Importance of Rudimentary Gamification are significantly different. The Positive Effect of the Image on language learning is significant only at the 0.1 significance level.

The hypothesis that the means of all external factors, the independent variables collected in the Participation Background Survey, are equal cannot be rejected at the 0.05 significance level.

Table 7

Results of Student's t-test for different means between treatment and control group.

	p-Value of Student's t-test for different means
Perceived improvement	0,0402
General Acceptance	0,2630
Place and time flexibility	0,2664
Motivation and enjoyment	0,1147
Positive effect of image	0,0982
Rudimentary gamification	0,0029
Difficulty	0,5195
Experience with 9GAG	0,1284
Studying a foreign language now	1
Planning to study a foreign language in the near future	0,6525
Spanish learner	1
Satisfaction with performance of smartphone device	0,4675
Experience with mobile language learning applications	1
Reached the end of the application's content	0,6525

Bootstrap hypothesis test of equality of densities

Due to the small amount of observations, the underlying assumption that the data is normally distributed is not statistically founded, so an alternative approach for testing the hypothesis of equal means is presented. The bootstrapping approach is based on the understanding that when any other information about the distribution of certain data is absent, than the observed sample has all the information about the underlying distribution. So bootstrapping is used to estimate the sampling distribution of estimators by randomly drawing with replacement from the original sample (Efron and Tibshirani, 1993).

The function *sm.density.compare* from the R Statistical Software package {sm} (SM-Package for R, 2014) was used to compare the density estimates of the dependent variables (cran.r-project.org). Below, a table is given which contains the p-values of the hypothesis tests for equal densities in the treatment and the control group. In all five runs of the test there was a rejection of the null hypothesis of equal densities, and consequently of equal means, for the "Perceived Improvement", the "Motivation and Enjoyment" and the "Importance of the Rudimentary Gamification". The number of samples generated in the bootstraps was each 100. The p-values in the different runs varied due to the way of estimating a bootstrap sample, namely by randomly drawing observations with replacement.

Table 8

Results of Bootstrap hypothesis test of equality of densities.

	Run 1	Run 2	Run 3	Run 4	Run 5
Perceived improvement	0	0,04	0,02	0	0
General Acceptance	0,36	0,37	0,41	0,44	0,35
Place and time flexibility	0,12	0,12	0,13	0,09	0,11
Motivation and enjoyment	0	0,02	0,01	0,01	0,01
Positive effect of image	0,38	0,29	0,43	0,4	0,4
Rudimentary gamification	0	0	0,01	0	0
Difficulty	0,6	0,66	0,53	0,64	0,53

A detailed graphical presentation of all densities is provided in the *Appendix F, Selected results of the surveys*, which is achieved by the method of a kernel density estimation (Azzalini and Bowman, 1997). Below, the densities for "Perceived Improvement" and "Motivation and Enjoyment" are displayed.

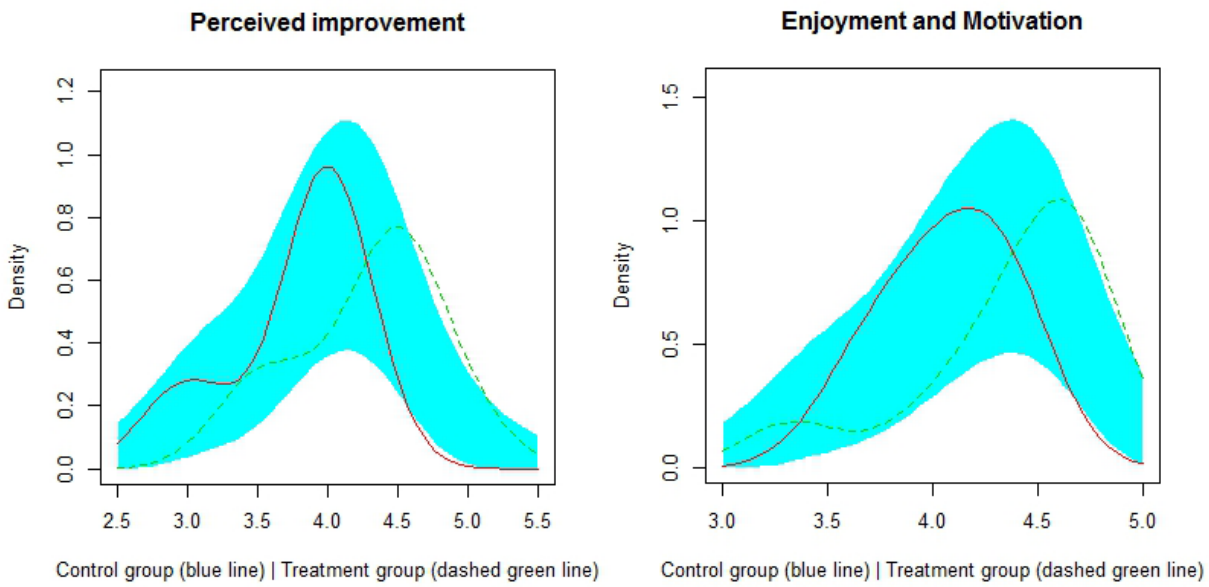

Fig. 5 Density diagrams from bootstrap testing of the variables "Perceived improvement" and "Enjoyment and motivation".

4.4.3. Correlation – dependence analysis

In order to investigate the data for any dependences between the dependent variables stemming from the opinions of the participants and the independent ones stemming from external factors such as satisfaction with the performance of the mobile device or the current studying of a foreign language a correlation analysis was conducted. The Pearson Correlation

Coefficient, a measure for the linear association between two values, was estimated for all variable pairs. Only correlations of the variable pairs that are significant at the value of about 0.1 are displayed in table below.

Table 9

Results of correlation analysis.

		Correlation	p-Value
Place and time flexibility	Difficulty	-0,6606	0,0528
Place and time flexibility	Studying a foreign language	-0,6124	0,0796
Perceived improvement	General Acceptance	0,6351	0,0661
Rudimentary gamification	Satisfaction with performance of smartphone device	0,6396	0,0636
General Acceptance	Positive effect of image	0,6928	0,0386
Difficulty	Studying a foreign language	0,7416	0,0222
Difficulty	Finished all sections	0,7416	0,0222
Importance of gamification	Experience with 9GAG	0,7500	0,0199
Studying a foreign language	Experience with mobile language learning	0,7906	0,0112
Perceived improvement	Motivation and enjoyment	0,8536	0,0034

All pairs of variables display a high correlation with the three top pairs being negatively correlated, whereas all the ones below them being positively correlated. In the *Discussion* section the importance and meaningfulness of these dependencies will be interpreted.

An alternative way to control for the possible effect of an external factor on a dependent variable is by fixing the external variable at a specific value and comparing the means of the newly created ad hoc groups. The external factors were accordingly Experience with mobile language learning (binary), whether the participant was a Spanish learner (binary), the Satisfaction with performance (threshold at 3), Finishing all image-phrase units (binary), Experience with 9GAG (binary) and the perceived Difficulty (threshold at 4). Running a Student's t-test for different means revealed only two significant dependencies at the 0.05 alpha level:

a) the participants who perceived the vocabulary as less difficult were more probable to finish all the image-phrase units ($p = 0.0298$), and
b) the participants who perceived the vocabulary as less difficult evaluated Time and Space Flexibility as more important (means were respectively 3.96 and 3.1; $p = 0,0436$)

The other p-value estimates could be found in the *Appendix F, Selected results of the surveys*.

4.5. *Personal opinions and final open-end question*

As is suggested by (Dörnyei and Ushioda 2013: 207) the disaggregation of group data into individual observations corresponding to single participants might reveal essential qualitative insights about the system and the language learning approach. In this research this disaggregation will be attempted by analysing the open end questions at the end of Final Evaluation Survey revealing both critical comments about the system, and comments about the personal perception of the learning process. Below, in Table 10 a summary of the main points shared by participants is presented. An analysis will follow in the Discussion section and the entire comments could be found in the *Appendix F, Selected results of the surveys*.

Table 10

Summary of participants' comments at the end of the Final Evaluation Survey.

	Summary of comments
Treatment Group	• "Audio was too low" • very engaging, helpful for learning, "not a boring moment", adding an exam after each section could be beneficial to learning success • "Not the main language learning app", meanings were guessed "based on context in images", do not understand the grammar behind the phrases, app that is assisting more language-centered but boring applications • "more interesting and more appealing to the new generations"
Control Group	• "a good way to learn vocabulary", "too easy but that is the point of repetition", a test to measure success • Arrange phrases thematically, general liking of the idea • High complexity of phrases, prefers single words ("starting from the middle") • New words should repeat more often in different contexts • Usability suggestions about showing whether a choice was a correct one (a green "Correct" instead of a smaller-sized image) • "more useful than similar ones", "additional learning methods might be involved" to improve user experience • "too repetitive", add "bigger variety of learning tools", add "testing points to measure my progress"

5. Discussion

5.1. Analysis of results

5.1.1. Non-normality of data

As already stated in the *Results* section, most variables extracted from the Final Evaluation Survey cannot be assumed to be normally distributed. The results from the Shapiro Wilks test are a statistical indication for this.

Abstracting from the facts that, firstly, data is negatively skewed because participants have seldom chosen very negative values, and, secondly, there are two artificial limits to the possible responses (1 for strong disagreement and 5 for strong agreement), there are three probable reasons why data is not normally distributed. To begin with, there is insufficient data discrimination due to the low number of possible values to be taken for each variable. Moreover, the total number of observations is relatively low and, lastly, there are two underlying distributions that overlap and give the impressions that data is bimodally distributed. The last reason would be an indication that there are true differences between the treatment and the control group.

The analysis of the histograms of the dependent variables could only partially assist the assessment of data distribution due to the high granularity of the data. Only the histograms of Motivation and Enjoyment and Perceived Difficulty reveal a rather uncontroversial picture – bimodal distribution for the former variable, and unimodal for the latter one.

5.1.2. Independent variables

To minimize the risk of any unexpected dependencies and violations of internal validity, the author controlled for several factors that were assumed to have an influence on user's perception of the system and the learning process.

First of all, the author tried to ensure that participants have a similar initial motivation (pre-actional phase) for taking part in the experiment. The Table 11 below shows clearly that the different reasons chosen by participants are approximately the same. Other reasons that were not included by the author of the research paper in advance are possible but accepted to be of low importance due to the relatively low time investment on the side of the participants in the experiment. Comparability of initial motivation is thus ensured.

	Wishes to help a friend	Spanish learner	Try out a new language learning approach	Interest in the novelty of the app
Treatment group	**4,89**	**2,33**	**4,11**	**4,00**
Control group	**4,56**	**2,33**	**4,22**	**4,00**

Table 11

Initial motivation of participants to take part in the experiment.

All other demographic or language learning experience factors were comparable (if not similar) in both groups as shown in the *Results* section. In order not to mix the effects of initial motivation and executive motivation, it was important to pay special attention to any Spanish language learners. Firstly, there was the exact number of Spanish present or future learners in each of the two groups (each two). Secondly, after analyzing whether being a Spanish learner (independent of the fact to which group the participant belonged), no significant difference in the responses of these participants could be observed. One can conclude, that the differences in the external motivation of participants had no effect on their behavior in the experiment.

The external factor "Experience with 9GAG" was also proven to not have a statistically significant different effect on participants' perception of the language learning application Punny. This finding is of high importance for the external validity of results, since it means that if a positive effect of the entertaining content on learner's motivation could be proven, it would be valid for both learners who are part of the online communities like 9GAG, and for those who are not.

The last external factor that had to be controlled for was "Satisfaction with the performance of the smartphone device". With a p-Value of 0.4675 in the Student's t-test for different means the average satisfaction in both groups was not significantly different. The responses of participants who had a satisfaction with their device of below three were also not significantly different for any of the dependent variable. One can conclude, that the performance of the devices had no large effect on the behavior of participants in the experiment. Still, it is important to note, that users were explicitly asked to use the application when they were connected to a WiFi-Internet and not when only using the Mobile Data connection. This was a measure to decrease the risk of technology-provoked usability problems.

5.1.3. General acceptance of the platform

The variable "General acceptance" combined items from the Final Evaluation Survey which were very general in their meaning covering even general willingness to study Spanish (e.g. "Using the Punny app I am willing to engage in further Spanish learning activities."). It is perceived by the author as a major shortcoming, that these items obviously concern initial motivation to study a foreign language which was not at the core of the research paper. Moreover, only four of the 18 participants had any intention of actually studying Spanish. Another downside of this set of items is the danger of a higher Hawthorne effect: having the author of the research as their friend, users would most probably not be too negative in their responses even if they do not like the application. It is not surprising that the results for this variable are close (3,85 for the treatment group and 4,07 for the control group) and that they are in a certain contradiction to the direction of the other variables representing some form of approval for the language learning approach. The mean values for "Perceived improvement" and "Motivation and Enjoyment" are higher for the treatment group. Lastly, neither the Student's t-test, nor the Wilcoxon Signed – Rank Test or the Bootstrap hypothesis test of equality of densities identified that there is a significant difference between the means of the variable for the two groups.

For all the reasons stated, the variable "General acceptance" will not be used for the further analysis of the Research questions.

5.1.4. Research question 1

"Do we observe an increase in learners' executive motivation when studying foreign language vocabulary with the entertaining image meme approach? "

Three sources of information could be used to evaluate whether participants in one of the groups, control or treatment, perceived and in reality were more motivated to use the language learning platform Punny: the log-data from Google Analytics, the quantitative data from the Final Evaluation Survey and the free-text comments in the end of the survey submitted by some of the participants.

Log data from Google Analytics

Although the information from Google Analytics was rather rough and does not allow in-depth analysis of user behaviour, it revealed that the average session duration in the treatment group (10 min 32 sec) was more than twice the session duration of the control group (4 min 20 sec) with almost the same number of sessions (13 and 14 respectively). This is a clear

indication that the entertaining content kept the attention of the learners for a longer time in spite of the fact it was used for stimulating learning. The average number of pages per session is only slightly higher in the treatment group, the mode, however, 4.67 is more than twice larger: it is only 2.00 in the control group. The standard deviation in the number of pages per session in the control group is much higher because of two users with, respectively, six and eight pages looked at. This might either be explained with, unfortunately for the research findings, a technical failure of the system to capture some user behaviour, or with the fact that these two users opened some application pages more than once (not necessarily reading them completely). This could be interpreted as a confirmation of the lower willingness of most control group participants to engage with the neutral content of the system.

Quantitative data from the Final Evaluation Survey

The dependant variable "Motivation and Enjoyment" consists of three items with a slightly different emphasis on motivation or enjoyment. The first item's accent ("I find the learning approach of the Punny app very entertaining.") is on the general entertainment value of the application. It is perceived as higher in the treatment group. The second one ("I enjoy guessing the meaning of Spanish phrases from different options without having previously studied Spanish.") is concerned with the playfulness of the application. It is much higher in the treatment group (4.56 vs. 3.88). The available data is not enough to decide which the exact psychological source of the effect is. Still, a possible hypothesis is that the interaction between the more sophisticated content of the entertaining memes and the guessing of the unknown meaning of Spanish phrases causes the higher enjoyment. The third item ("Placing every single Spanish word or phrase in a specific context by using images is central to my motivation to use the Punny app.") is concerned with contextual vocabulary learning. The mean values in the groups only slightly differ (3.88 in the treatment group and 4.00 in the control group). Assuming that image memes offer a much richer context as discussed in the beginning of the section, this is either an indication that contextualization is not that important to participants which would be in contradiction to other authors (Prince, 1996), or that the self-report measure of the link between contextualization and motivation is a suboptimal choice of the author of the current paper. As shown in the *Results* section, there is a significant difference ($p \sim 0.01$) in the distributions and means of the combined variable "Enjoyment and Motivation" in the bootstrap test which despite the small sample size and some possible item design flaws is an indication for an effect on motivation caused by the entertaining content.

Qualitative data from the Final Evaluation Survey

Lastly, the content of the comments about the participants' experience in each of the groups differed strongly. In three of the four comments in the treatment group users accented on the higher engagement of the application and the interesting content. In four of the seven comments in the control group participants mentioned in one way or another the concept of "repetitiveness": a need for variation was expressed. Comments were not explicitly negative, but generally included some advice at how to improve the application, whereas in the treatment group they were (except for one) all emphasising the motivational value.
In conclusion, there are clear indications that users become more involved in the language learning process thanks to the entertaining content. The different aspects of increasing the motivation should be analysed in further studies.

5.1.5. Research question 2

"Do learners exposed to the entertaining image meme content demonstrate a higher level of reported improvement of Spanish ability?"

Quantitative data from the Final Evaluation Survey

The items included in the variable "Perceived improvement" correspond to either vocabulary learning ("Using the Punny app improves my Spanish vocabulary set."), or general usefulness ("In general, I think the Punny app is a useful tool for language learning."). The mean of the variable in the treatment group is statistically significantly larger both in the Student's t-test, and the bootstrap test. Whether the perceived improvement translates into actual improvement of the language skills should be analyzed with further research studies including pre- and post-tests of the newly acquired knowledge.

Qualitative data from the Final Evaluation Survey

The content of the free-text comments about the participants' experience in each of the groups differed in concern to the perceived improvement of Spanish skills. The treatment group seemed to be primed to comment on the engagement of the app-content and less on language learning matters. One comment is revealing as far as the advantages, and the disadvantages of the learning approach are concerned: it is a "helpful secondary learning app. It can be very interesting when used together with Duolingo, or any other similar app, that mostly lack the fun part in learning." Interestingly enough, the attention of the control group, without the distraction of entertaining memes, was directed entirely towards the learning process and

ways to improve it. Most notably, users desired tests of the vocabulary learnt, higher usability and additional learning methods in order to decrease repetitiveness.
In conclusion, there is evidence that learners using the entertaining content believe they have an increase in their Spanish ability.

5.2. Mobile learning and meme images

Based on the previous research findings presented in the *Literature Review* section and on the results presented in the *Results* section and discussed in subsections 6.1.4 and 6.1.5 above (Research Questions 1 and 2), the author arguments that humorous image memes make authentic, personal and contextual learning of foreign language vocabulary possible.

5.2.1. Authenticity

As far as authenticity is concerned, browsing through humorous memes can be seen as a "direct participation in the actual work of the focus community" (Radinsky et al., 2001). One could argue that the actual activity is "having fun" and the learning is a positive side effect. In addition, the actual creation of new entertaining content, presenting a constructivist way of learning, would be another truly authentic way to immerse in the language. Unlike the simulated learning environment presented in the *Move Idioms project* (Wong, 2012) where visual artefacts were created in an artificial situation (homework), studying with memes can be of interest for learners without a teacher's facilitation. Lastly, having in mind that lots of the users of the leading platforms for memes such as 9GAG are not English native speakers, so one could easily imagine that curated content adapted for the proficiency level of learners could also be used for teaching the language. One risk, however, should be taken into consideration, namely, that learners might blend out the language learning content and focus on entertainment. User behavior on 9GAG involves a voracious consumption of images which often means dedicating little attention to each single one. So, as far as the goal of language skills improvement is concerned, this practice should be taken into account. In the Punny application this was done by making learners think of and choose the possible meaning of a word and by including the repetition of some content.

5.2.2. Personalization

As far as personalization is concerned, the activity involved in the here suggested language learning approach is standardized (browsing through images). Self-regulation and autonomy about when and where to study are trivially given thanks to the mobility of the smartphone. More interesting is, however, the customization of content. There are two reasons why

personalization is very high. Firstly, the huge variety of possible humorous situations displayed in visual memes and the number of visitors of platforms like 9GAG (9GAG pledges more than 80mln monthly visitors and millions of images and videos on its site (Russel, 2015)) can match the interests and sense of humor of vast amount of users. Secondly, because of the variability of the humorous content, more aspects of one's social identity get involved in the learning process. Since other identities such as e.g. being a university student, a white-collar worker or a dog-owner might matter more to the motivational process of learning than being a language learner (Ushioda, 2009), the variety of entertaining themes activating different aspects of the social identity might consequently increase the learning engagement. The ability of learners to consume content as themselves or "speak as themselves" (Legenhausen, 1999) and to recognize their own position expressed by another user (or learner), might be central to their motivation for continuing their learning.

5.2.3. Contextualization

Memes are contexts in themselves which tell entire stories. According to Vygotsky's (1978) social constructivism theory learners create their understanding of new content through one own's experience or the interaction with others. Memes are a "shared cultural experience" (Conte, 2000, Shifman, 2013) and it could easily be argued that they fit very well in the educational theory of social constructivism. They enable learners to quickly make sense of words and phrases by comprehending the contexts and raise learner's engagement and interest by presenting real and not artificial stories.

5.2.4. Place and time flexibility, added functionality

The variable "Place and time flexibility" reveals the importance of mobility for language learners in the context of the application Punny. None of the paired difference tests was able to reject the null hypothesis that both groups have the same mean. Similarly, users' preferences for added functionality such as the ability to save words for later repetition or a sharing functionality were similar in both groups. One conclusion that could be drawn here is that the due to the design of the experiment which concentrated on executive motivation and the learning content and due to the choice of participants, mostly non-learners of Spanish, the willingness to use the application in varying circumstances and with situation-specific functionalities could hardly be assessed.

5.2.5. Difficulty

The "Perceived Difficulty" of the vocabulary learnt was only measured to ensure comparability in both groups. There is strong visual and statistical evidence that the

distribution of the variable is normal and that the vocabulary was similarly hard for both groups.

5.2.6. Rudimentary gamification

A surprising statistical result can be observed from the variable Rudimentary Gamification ("Seeing my progress with the completion of tasks is very important for my motivation to continue using the Punny app"). This is the only variable for which all paired tests consistently rejected the null hypothesis for equal means in the two groups. The *importance of the observed progress* was significantly lower for the treatment group participants.

Although the result might be a random event due to the low number of participants, it still points at an interesting question. Could intrinsic motivation, caused by the heightened interest of users in the entertaining content of the application, crowd out the effect of gamification based on extrinsic motivation?

Intrinsic motivation is defined as "doing something because it is inherently interesting or enjoyable" while the extrinsic motivation "refers to doing something because it leads to a separable outcome" (Ryan and Edward, 2002). Among the gamification instruments based on stimulating users' extrinsic motivation are the achievements for fulfilling some tasks (awards, badges), observing one's progress through an activity (levels, score, points) and reputation (leaderboards, ratings) (Deterding, 2011). It is empirically proven that rewards as a means to increase extrinsic motivation can lead to the diminishing of intrinsic motivation which is described by the overjustification concept (Lepper et al., 1973). A practical implication of the opposite effect, intrinsic motivation making extrinsic motivation irrelevant, would be to save resources dedicated to designing gamification features for learning environments. If for example school students are inherently interested in a subject, evaluation marks would not be necessary. Similarly, if mobile language learning applications expose learners to an authentic engaging activity, any ratings, progress or artificial awards might be superfluous.

6. Conclusion

This research paper analyzed how people perceive entertaining learning material when learning a foreign language on their smartphone devices. A prototype of a language learning application was built and an experiment with 18 participants was conducted with its help.

Using humorous image memes, a part of contemporary online culture, learners spent voluntarily longer time learning with their smartphones and stated directly that they felt more

motivated to study. Entertaining content had a positive effect on learners' executive motivation. Moreover, the perceived improvement of language skills of learners was higher when studying with the humorous content.

The author argues that mobile learning with entertaining image memes is authentic, personalized and contextualized. Learners are involved in a truly engaging activity which allows them to act as their true selves - and not only from the position of a language learner - which further increases their dedication to the learning activity.

The study has several imperfections that have to be taken into consideration or improved in future research projects. Firstly, the software system which was the base for the experiment was technologically simple and did not allow to collect information for some other relevant behavior (e.g. sharing of memes or creating of new ones). Secondly, the low number of participants, 18 in total, did not provide sufficient data for more rigorous statistical analysis. Thirdly, the absence of pre-tests and post-tests of the language knowledge of the participants did not allow any conclusions about the objective improvement of language skills. Still, the current research can be seen as a base for further tests with extended functionality of the applications, a larger number of participants and a broader set of target variables tested.

Humor has sporadically been used in traditional language learning education but seems to be absent from modern mobile software applications. The leading language learning applications rely exclusively on gamification and the methods of goal setting theory to motivate learners in the executive phase of learning. The central implication from this research paper is to introduce entertainment in the process of studying in order to reduce churn rates and increase learners' desire to study. Visual content in the popular applications can be easily substituted with a more appealing one.

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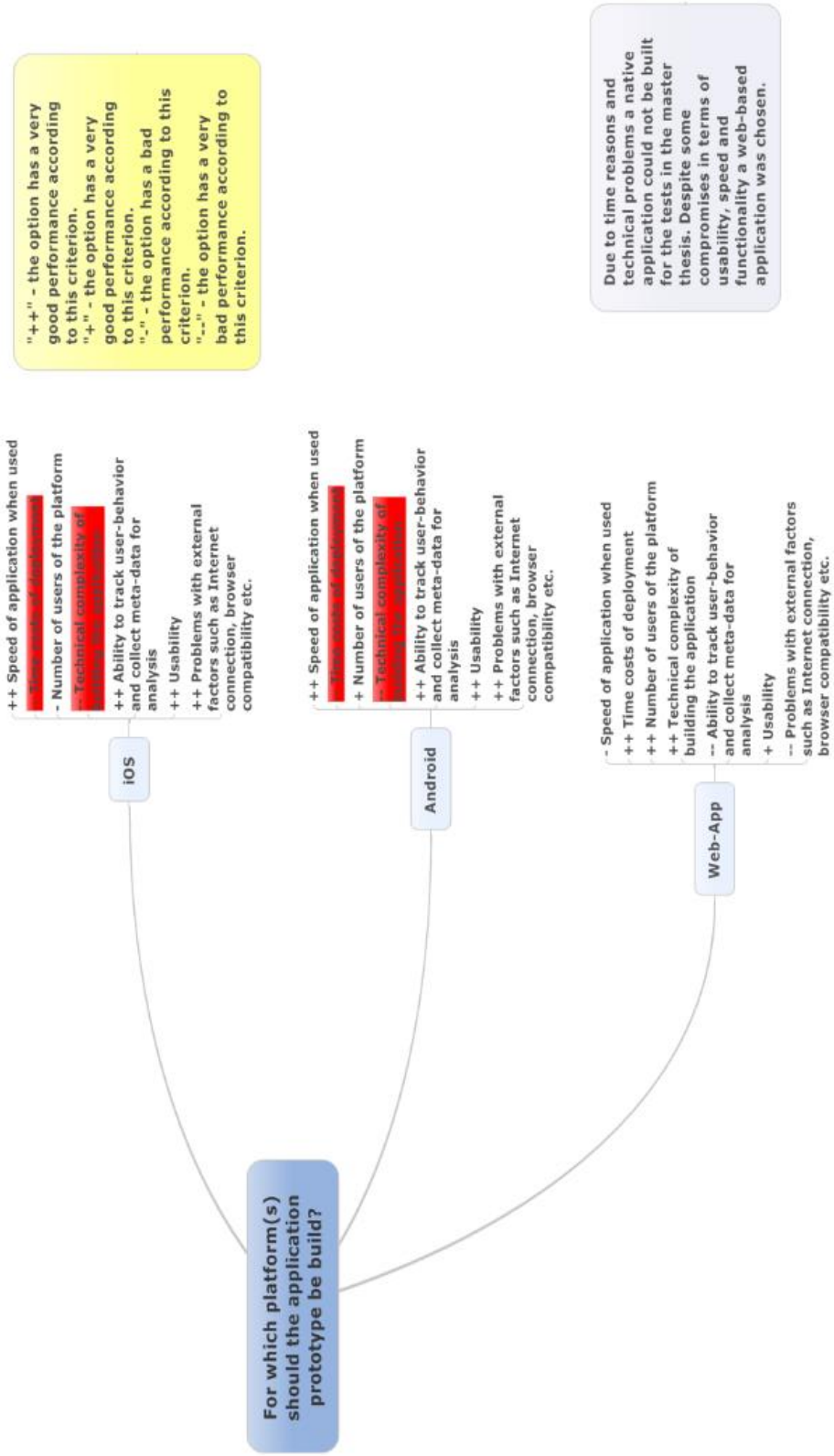
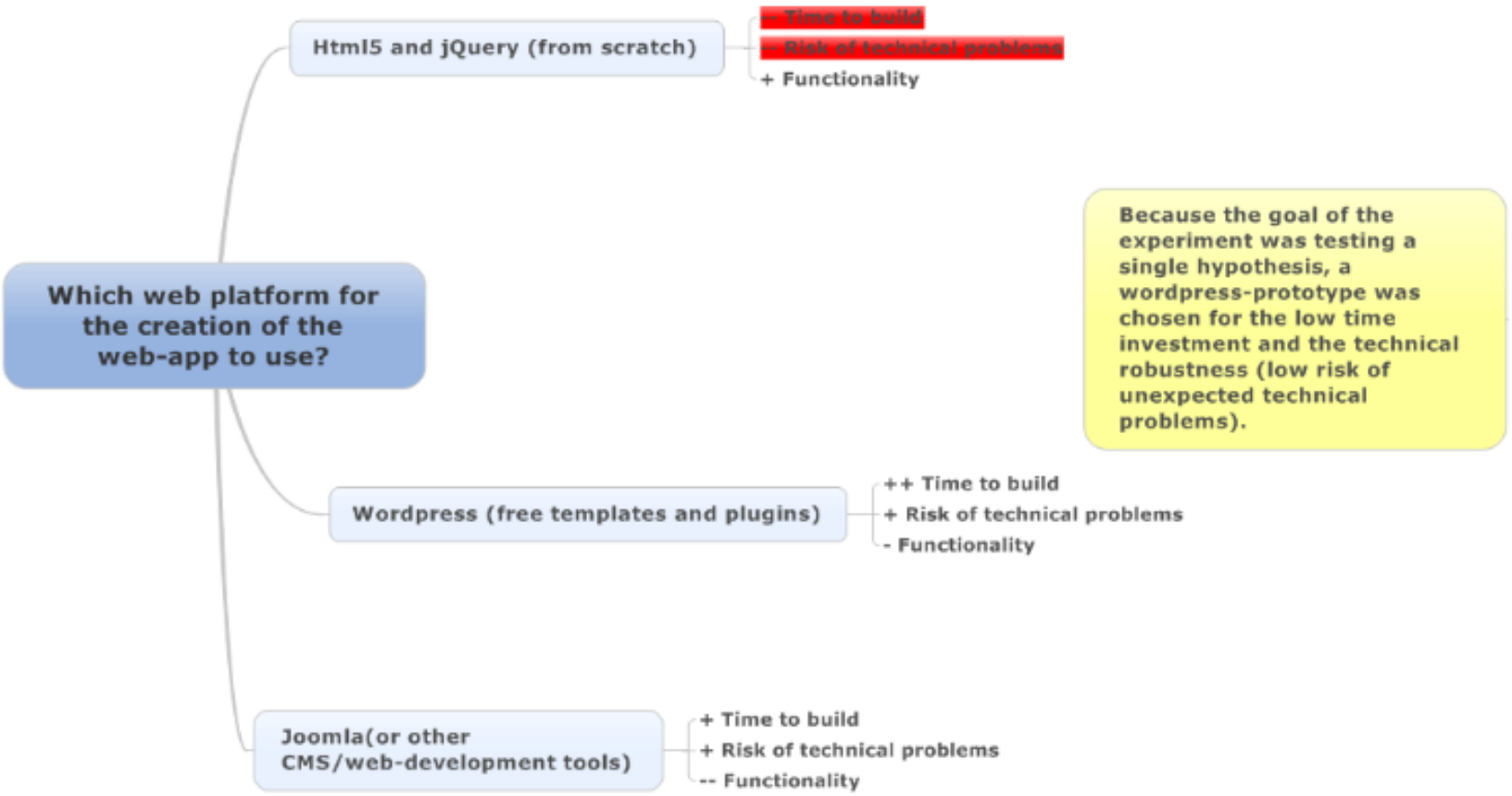
Appendix

A. GIBIS for System Design Decisions




Which web platform for the creation of the web-app to use?
Html5 and jQuery (from scratch)
-- Time to build
-- Risk of technical problems
+ Functionality
Because the goal of the experiment was testing a single hypothesis, a wordpress-prototype was chosen for the low time investment and the technical robustness (low risk of unexpected technical problems).
Wordpress (free templates and plugins)
++ Time to build
+ Risk of technical problems
- Functionality
Joomla(or other CMS/web-development tools)
+ Time to build
+ Risk of technical problems
-- Functionality


How should the translation of the foreign language text be presented (given: a proper combination of the 9GAG-model and flashcards is looked for)?
Juxtaposing the same images, one with the text in the foreign language, one in the native one.
-- Usability (screen size)
-- Loading speed (Internet connection etc.)
Only the image in the foreign language could be seen, but after one click on it the user sees the same image with the translation
+ Usability (screen size)
- Loading speed (Internet connection etc.)
Only the image in the foreign language could be seen, but after one click on it the user sees the translation (no image)
+ Usability (screen size)
+ Loading speed (Internet connection etc.)
Only the image in the foreign language could be seen, possible translations are given as a multiple choice question below. Clicking the correct one gives a visual feedback.
++ Pedagogical concerns (Attention to foreign language, repetitiveness of tasks)
- Usability (screen size)
+ Loading speed (Internet connection etc.)
The decisive criterion here was pedagogy. In three of the four options users would be inclined to click or scroll quickly through the images and phrases not paying enough attention to the foreign language.

B. Participant Surveys

Participant Background Survey

A few hours after you have filled up this brief survey, you will receive an sms with the link to the application and a few instructions. Please, answer all the questions.

1. **First name**

2. **Family name**

3. **Gender**
   - Female
   - Male

4. **Age**

5. **Cell phone number (please, add you country code)**

It is only needed for sending you the link to the mobile web-app.

6. **Your native language(s)?**
   - German
   - Bulgarian
   - English
   - Other:

7. **How satisfied are you with the technical capabilities of your current smartphone?**

e.g. speed, unexpected stops, frequent problems with the Internet connection due to the smartphone (more than once a day)

   - Very satisfied
   - Satisfied
   - Neutral
   - Not satisfied
   - Not satisfied at all

8. **Have you used your smartphone before to study a foreign language?**
   - Never
   - Only a few times
   - Occasionally
   - Relatively often
   - Very often

9. **Which application(s) did you use to study a foreign language? (e.g. Babbel, Duolingo, but also an ebook in a foreign language?)**

10. **Why did or did not you use your smartphone for foreign language learning?**

11. What is your overall English level?

- Very good (B2)
- Excellent (C1/Advanced)
- Proficient (C2/Proficiency)
- Native speaker

12. What other foreign languages have you studied and what is your level? (Beginner (A1-A2), Intermediate (B1-B2), Advanced (C1-C2))

e.g. Russian A2, French B1 etc.

13. Are you currently studying a foreign language?

- I'm attending an intensive course. (more than 6 hours with a teacher per week)
- I'm attending a normal course. (less than 6 hours with a teacher per week)
- I'm intensively studying a foreign language on my own. (more than 6 hours per week)
- I'm studying a foreign language on my own. (less than 6 hours per week)
- I'm not studying a foreign language right now.

14. If you are studying a foreign language right now, what is it?

- None
- Other:

15. If you are planning to start studying a foreign language in the 6 months, what is it?

- None
- Other:

16. What are your strongest reasons to participate in this upcoming test of the language learning app "Punny"?

	Not important at all	Not important	Neutral	Important	Very important
I'd like to help a friend with his master thesis	☒	☒	☒	☒	☒
I'm studying Spanish, so it might be useful.	☒	☒	☒	☒	☒
I wish to try out a new language learning approach.	☒	☒	☒	☒	☒
I'm interested in the new smartphone app.	☒	☒	☒	☒	☒

Final evaluation - Punny app

Name

1. **Using the Punny app improves my Spanish vocabulary set.**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

2. **I would use the Punny app for studying another foreign language (different from Spanish).**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

3. **Using the Punny app I am willing to engage in further Spanish learning activities.**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

4. **I like using the Punny app for studying vocabulary.**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

5. **In general, I think the Punny app is a useful tool for language learning.**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

6. **I feel that studying at different places is very important for my learning success when using Punny.**
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree

7. I feel that studying at various times of the day is very important for my learning success when using Punny.

- o Strongly agree
- o Agree
- o Neutral
- o Disagree
- o Strongly disagree

8. I find the learning approach of the Punny app very entertaining.

- o Strongly agree
- o Agree
- o Neutral
- o Disagree
- o Strongly disagree

9. I sometimes wish I could also add my own images in the application.

- o Strongly agree
- o Agree
- o Neutral
- o Disagree
- o Strongly disagree

10. I find sharing some of the images and phrases with friends of mine might be helpful for learning the language.

- o Strongly agree
- o Agree
- o Neutral
- o Disagree
- o Strongly disagree

11. Have you ever used the entertainment platform 9GAG (or its similar ones)?

- o Yes, both on my smartphone, and on my computer.
- o Only on my computer.
- o Only on my smartphone
- o No

12. Seeing my progress with the completion of tasks is very important for my motivation to continue using the Punny app.

- o Strongly agree
- o Agree
- o Neutral
- o Disagree
- o Strongly disagree

13. I enjoy guessing the meaning of Spanish phrases from different options without having previously studied Spanish.

- o Strongly agree
- o Agree

- Neutral
- Disagree
- Strongly disagree

14. I find new words are easier to remember thanks to the image content.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

15. Placing every single Spanish word or phrase in a specific context by using images is central to my motivation to use the Punny app.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

16. Being distracted by the images used in the Punny app hinders my learning progress.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

17. Saving a foreign phrase for later repetition might be helpful.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

18. I find new words should be repeated more often in the Punny app.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

19. How hard was it for you to guess the meaning of the Spanish phrases?

- Very hard
- Mostly hard
- Hard
- Neutral
- Easy
- Mostly easy
- Very easy

20. What was the decisive factor for your success at learning new Spanish words?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The image	☒	☒	☒	☒	☒
The words that are similar in both Spanish, and English	☒	☒	☒	☒	☒
The suggestions below the picture	☒	☒	☒	☒	☒
The repetition of a word in a new image-context.	☒	☒	☒	☒	☒

21. Which of the different types of images help you remember the most Spanish words? [Question included only in the evaluation of the treatment group.]

	Not helpful at all	Only of little help	Somewhat helpful	Helpful	Very helpful
Animals (or objects) in human roles	☒	☒	☒	☒	☒
People in absurd situations	☒	☒	☒	☒	☒
Movie quotes	☒	☒	☒	☒	☒
References to movie heroes	☒	☒	☒	☒	☒
Rereferences to own habits or funny details of life	☒	☒	☒	☒	☒

22. Is there anything else you would like to share as an experience, recommendations, observation or general advice?

C. Communication with participants and instructions

E-Mail initiating the communication with participants

Dear <Participant Name>,

Thank you very much for your willingness to support me with my master thesis by testing the web-based application for language learning "Punny". The master thesis is being written at the Humboldt University of Berlin and it is an attempt at gaining better understanding of how people can effectively study with mobile devices. The language you will have the chance to study for a few minutes is Spanish.

Under the following link you will find a short "Participant Background Survey" you have to fill up before receiving the link to the application per sms. All your information will be kept privately and only be accessible to the researcher (Alexander Naydenov) and the two supervising professors of the master thesis (Prof. Pinkwart and Prof. Breidbach).

If you have any questions, do not hesitate to ask. I am really thankful for your help!

- **The entire test consists of three short parts:**
- **The completion of this current form collecting some general information about your background (e.g. languages you have studied before)**
- **The use of the web-based application "Punny" (it would only take a few minutes).**
- **The completion of a second short form about your experiences with the application.**

"Punny" is web-based and runs on all phones. It is simple to use, so feel free to use it in whatever way you like. The goal is to evaluate your natural feeling about it. Within the app, you will be exposed to ca. 70 of the most frequent Spanish words accompanied by their respective English translations. You don't need to study at once – you can split the usage of the app in two or three time learning slots at different times of the day.

Move to step 1: PARTICIPANT BACKGROUND SURVEY (Please, fill it out until 10am in the morning of June 8)

Yours,

Alex

SMS with instructions for using the application

It's Alex! A few tips about the app prototype for language learning:
- Use it until 12.06 (Friday), 10am.
- If you have a low mobile Internet limit, using the app with WiFi is recommended.
- Use it on your phone as many times as you want.
- Scroll down and click is all you need to do.

Have fun under: http://beta.punnyapp.com/

Final E-Mail with Evaluation Survey

Dear <Participant Name>,

Thank you once again for supporting me with my Master thesis! Your help has both a huge personal, and an academic importance for me!

The last step of the experiment and your participation is the final evaluation survey. The evaluation contains multiple-choice questions about your personal perception of the learning effect of the app. Please, answer as honestly as possible - do not hesitate to share both criticism, and praise.

Please, fill in **this 5-minute evaluation survey** about the Punny app-prototype until June 13 (tomorrow), 8pm in the evening by answering all the questions. (If you have not had the time, to use the app yet, you can still do it on your smartphone under http://beta.punnyapp.com/.)

Afterwards, I would be glad to share some very useful learning advice and, hopefully, in the near future to invite you for a coffee or beer!

Yours,
Alex

D. Source code for statistical analysis

```
###Analysis of experimental data from the "Participant background survey"
and the "Final Evaluation Survey"###

rm(list=ls())

test1<-read.csv("C:/Users/alex/Desktop/Master Thesis/Experiment data/test 1
- means.csv", sep=";",dec=",")
names(test1)
attach(test1)
head(test1)

###Descriptive Statistics----
#means, medians, standard deviations
length(Name) #total number of participants
length(test1[treatmentGroup==1]) #number of treatment group participants
length(test1[treatmentGroup==0]) #number of control group participants
meanTreatment=round(sapply(test1[treatmentGroup==1,-1],mean),2)
meanControl=round(sapply(test1[treatmentGroup==0,-1],mean),2)
sdTreatment=round(sapply(test1[treatmentGroup==1,-1],sd),2)
sdControl=round(sapply(test1[treatmentGroup==0,-1],sd),2)
medianTreatment=round(sapply(test1[treatmentGroup==1,-1],median),2)
medianControl=round(sapply(test1[treatmentGroup==0,-1],median),2)
mydata<-
cbind(meanTreatment,meanControl,sdTreatment,sdControl,medianTreatment,media
nControl)

install.packages("rJava")
install.packages("xlsx")
library(xlsx)
write.xlsx(mydata,"C:/Users/alex/Desktop/Plots/mydata.xlsx")

countVar<-vector()
countVar1<-vector()
for(i in 9:16)
{
  countVar[i-8]<-sum(test1[treatmentGroup==0,i])
  countVar1[i-8]<-sum(test1[treatmentGroup==1,i])
}
names1<-names(test1[9:16])
mydata1<-cbind(names1,countVar,countVar1)
write.xlsx(mydata1,"C:/Users/alex/Desktop/Plots/mydata1.xlsx")

#boxplots
namesTest1<-names(test1)
for (i in 2:8){
mypath <- file.path("C:","Users","alex","Desktop","Plots",paste("boxplots_",
namesTest1[i], ".jpg", sep = ""))
jpeg(file=mypath)
boxplot(test1[,i][treatmentGroup==1],test1[,i][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[i]))
dev.off()
}

{par(mfrow=c(2,2))
boxplot(test1[,2][treatmentGroup==1],test1[,2][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[2]))
```

```
boxplot(test1[,3][treatmentGroup==1],test1[,3][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[3]))
boxplot(test1[,4][treatmentGroup==1],test1[,4][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[4]))
boxplot(test1[,5][treatmentGroup==1],test1[,5][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[5]))
boxplot(test1[,6][treatmentGroup==1],test1[,6][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[6]))
boxplot(test1[,7][treatmentGroup==1],test1[,7][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[7]))
boxplot(test1[,8][treatmentGroup==1],test1[,8][treatmentGroup==0],names=c("
Treatment Group","Control Group"),
        col=c("yellow","blue"),main=names(test1[8]))}

#histograms
install.packages("Hmisc")
library(Hmisc)
hist.data.frame(test1[,2:8],nclass=4)

###Comparing the treatment and control groups via Kernel Density----
#Superimpose kernal density plots of two or more groups of data.
install.packages("sm")
library(sm)
par(mfrow=c(2,2))

sm.density.compare(test1[,2],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Perceived improvement")
sm.density.compare(test1[,3],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="General acceptance")
sm.density.compare(test1[,4],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Place and time flexibility")
sm.density.compare(test1[,5],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Enjoyment and Motivation")
sm.density.compare(test1[,6],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Positive effect of image on learning")
sm.density.compare(test1[,7],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Importance of rudimentary gamification")
sm.density.compare(test1[,8],treatmentGroup,xlab="Control group (red line)
| Treatment group (dashed green line)",model="equal")
title(main="Difficulty of vocabulary")

bootstrapPs<-vector()
  for(i in 2:8){
  bootstrapPs[i-1]<-
sm.density.compare(test1[,i],treatmentGroup,model="equal",display="none")}

###Inference Statistics----

#Shapiro-Wilks Test for Normality----

pValShapiro<-vector()
```

```
for(i in 2:8){
  pValShapiro[i-1]<-shapiro.test(test1[,i])$p.value
}
nullHHolds<-vector()
for (i in 1:length(pValShapiro)){
  if (pValShapiro[i]<0.05)
    {nullHHolds[i]="Evidence against normality"}
  else nullHHolds[i]="Normality holds"
}
isDataNormal<-cbind(names(test1[2:8]),pValShapiro,nullHHolds)

pValShapiroGroups<-vector()
for(i in 2:8){pValShapiroGroups[i-1]<-
shapiro.test(test1[,i][treatmentGroup==1])$p.value}
pValShapiroTrGroup<-vector()
for(i in 2:8){pValShapiroTrGroup[i-1]<-
shapiro.test(test1[,i][treatmentGroup==1])$p.value}
pValShapiroCoGroup<-vector()
for(i in 2:8){pValShapiroCoGroup[i-1]<-
shapiro.test(test1[,i][treatmentGroup==0])$p.value}
shapiroT<-
cbind(names(test1[2:8]),pValShapiroGroups,pValShapiroTrGroup,pValShapiroCoG
roup)
write.xlsx(shapiroT,"C:/Users/alex/Desktop/Plots/shapiroT.xlsx")

#Using the Wilcoxon Signed-Rank Test
pValWilcox<-vector()
for(i in 2:8){
  pValWilcox[i-1]<-wilcox.test(test1[,i][treatmentGroup==1],
test1[,i][treatmentGroup==0],paired=TRUE)$p.value
}
wilcoxS<-cbind(names(test1[2:8]),round(pValWilcox,2))

write.xlsx(wilcoxS,"C:/Users/alex/Desktop/Plots/wilcoxS.xlsx")
#Manual significance test----
stdevimp=sqrt((8*var(improvement[1:9])+8*var(improvement[10:18]))/16)
t=(mean(improvement[1:9])-
mean(improvement[10:18]))/(stdevimp*sqrt(1/9+1/9))

#Student t-tests for significant differences between groups----

###Significant differences between the two samples - Treatment Group and
#Control Group; Assumed normality.

meanTreatment=sapply(test1[treatmentGroup==1,-1],mean)
meanControl=sapply(test1[treatmentGroup==0,-1],mean)
sdTreatment=sapply(test1[treatmentGroup==1,-1],sd)
sdControl=sapply(test1[treatmentGroup==0,-1],sd)

ps<-vector()
for (i in 2:15){
  ps[i-1]<-
t.test(test1[treatmentGroup==1,i],test1[treatmentGroup==0,i],var.equal=TRUE
)$p.value
}

pVals<-
cbind(meanTreatment[1:14],meanControl[1:14],sdTreatment[1:14],sdControl[1:1
4],ps)

write.xlsx(pVals,"C:/Users/alex/Desktop/Plots/pVals.xlsx")
```

```
###Correlations-----

install.packages("Hmisc")
library(Hmisc)

#estimate corrs of treatment group
corsTreatment=round(cor(as.matrix(test1[treatmentGroup==1,-
c(1,16)],use="complete.obs", method="kendall")),2)
#p-Values/significance of corrs
resTreatment=rcorr(as.matrix(test1[treatmentGroup==1,-
c(1,16)],type="pearson"))
flattenCorrMatrix <- function(cormat, pmat) {
  ut <- upper.tri(cormat)
  data.frame(
    row = rownames(cormat)[row(cormat)[ut]],
    column = rownames(cormat)[col(cormat)[ut]],
    cor  =(cormat)[ut],
    p = pmat[ut]
  )
}
corsTreatmentOrd=flattenCorrMatrix(resTreatment$r,resTreatment$P)[order(fla
ttenCorrMatrix(resTreatment$r,

resTreatment$P)[,3]),]
write.xlsx(corsTreatmentOrd,"C:/Users/alex/Desktop/Plots/corsTreatmentOrd.x
lsx")

#estimate corrs of control group
corsControl=round(cor(as.matrix(test1[treatmentGroup==0,-
c(1,16)],use="complete.obs", method="kendall")),2)
resControl=rcorr(as.matrix(test1[treatmentGroup==0,-
c(1,16)],type="pearson"))
corsControlOrd=flattenCorrMatrix(resControl$r,resControl$P)[order(flattenCo
rrMatrix(resControl$r,resControl$P)[,3]),]

write.xlsx(corsTreatmentOrd,"C:/Users/alex/Desktop/Plots/corsControlOrd.xls
x")
#corrs of total sample
corsTotal=round(cor(as.matrix(test1[,-c(1,16)],use="complete.obs",
method="kendall")),2)
resTotal=rcorr(as.matrix(test1[,-c(1,16)],type="pearson"))
corsTotalOrd=flattenCorrMatrix(resTotal$r,resTotal$P)[order(flattenCorrMatr
ix(resTotal$r,resTotal$P)[,3]),]
write.xlsx(corsTotalOrd,"C:/Users/alex/Desktop/Plots/corsTotalOrd.xlsx")


###Effects of external factors on evaluation answers----
#If the participant has used language apps before, are his answers
different?

mlearnP<-vector()
for (i in 2:8){
mlearnP[i-1]<-
t.test(test1[,i][mlearner==0],test1[,i][mlearner==1],var.equal=TRUE)$p.valu
e
}

#If the learners studies or intends to study Spanish, are his answers
different?
spanishP<-vector()
for (i in 2:8){
```

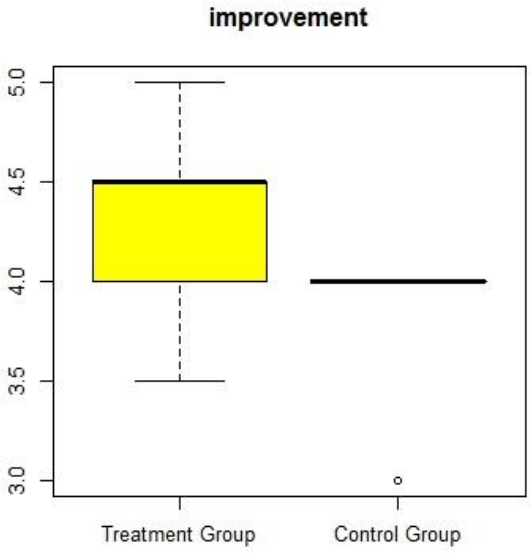
```
  spanishP[i-1]<-
t.test(test1[,i][spanish==0],test1[,i][spanish==1],var.equal=TRUE)$p.value
}

#Does the satisfaction with the smartphone have an effect on the evaluation
of the system?
phoneP<-vector()
for(i in 2:8){
  phoneP[i-1]<-
t.test(test1[,i][satisfiedPhone<=3],test1[,i][satisfiedPhone>3],var.equal=T
RUE)$p.value
}

#Not all participants have gone through all the image-phrase units. Is
there a difference between the evaluations of both types of participants?
punctP<-vector()
for(i in 2:8){
  punctP[i-1]<-
t.test(test1[,i][punctuality==0],test1[,i][punctuality==1],var.equal=TRUE)$
p.value
}

#Do the users who know the 9GAG platform have different answers than the
ones who do not know it?
user9gagP<-vector()
for(i in 2:8){
  user9gagP[i-1]<-
t.test(test1[,i][user9gag==0],test1[,i][user9gag==1],var.equal=TRUE)$p.valu
e
}

#Does the experienced difficulty level have an effect on participant's
evaluation?
difficultyP<-vector()
for(i in 2:7){
  difficultyP[i-1]<-
t.test(test1[,i][difficulty<=4],test1[,i][difficulty>4],var.equal=TRUE)$p.v
alue
}
mean(test1[,4][difficulty<=4])
mean(test1[,4][difficulty>4])

namesEv<-names(test1[2:8])
mydata4<-
cbind(namesEv,mlearnP,spanishP,phoneP,punctP,user9gagP,difficultyP)
write.xlsx(mydata4,"C:/Users/alex/Desktop/Plots/mydata4.xlsx")
```

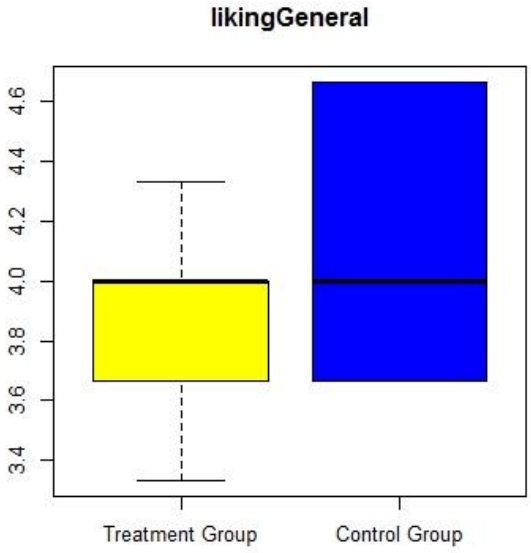
E. The most frequent 100 words in Spanish

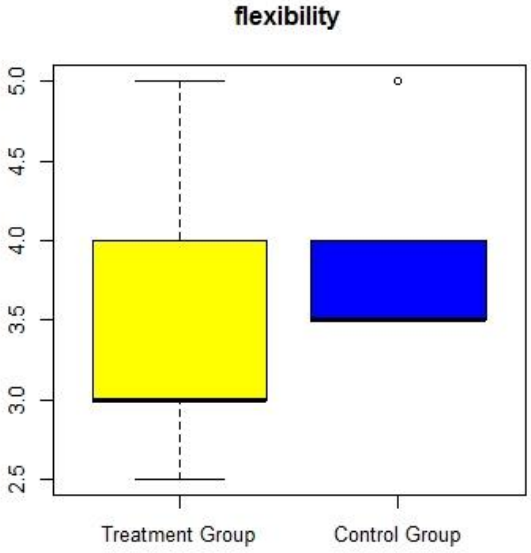
Among the most frequent 100 words (n = 62)		Additional words (n = 22)
time	Good bye!	dear
person	Good night!	Monday
year	See you tomorrow!	dream
way	Good morning!	beer
day	Hello!	coffee
thing	How old are you?	beer-belly
man	girl	six-pack
world	love	orange
life	more	juice
old	please	wine
part	man	milk
game	black	age
good	lady	nap
woman	mother	fair play
place	brother	sun
work	father	second
go	lunch	war
know	breakfast	hard
take	dinner	hug
government	free	drink
work	world	hangover
give	peace	animal
group	choice	
problem	happy	
be	beautiful	
have	people	
bad	nothing	
same	I	
life	you	
death	word	
enjoy	money	

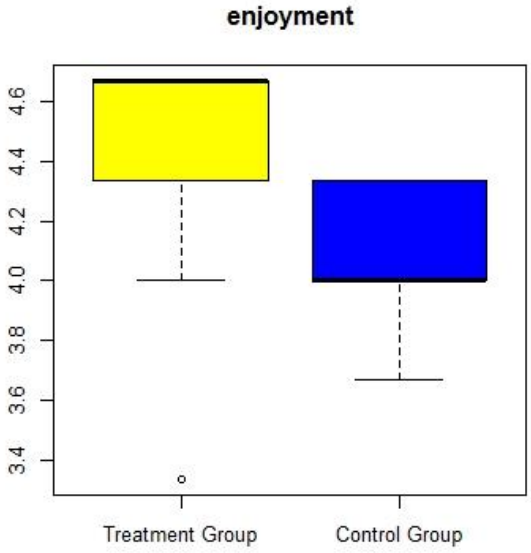
F. Selected results of the surveys

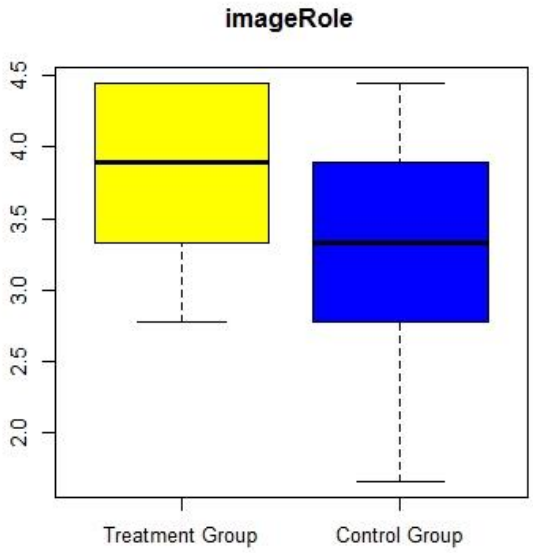
Boxplots of dependent variables

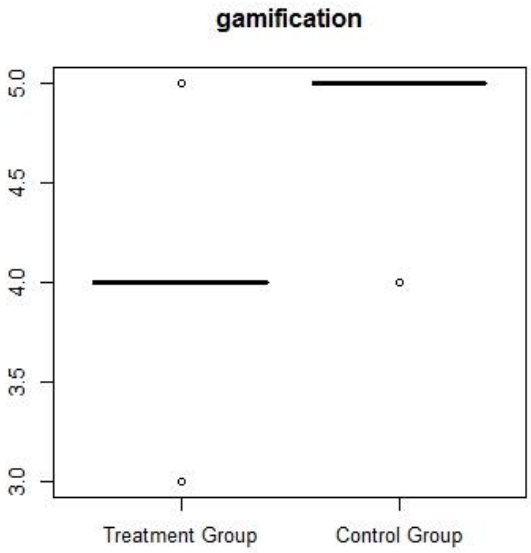


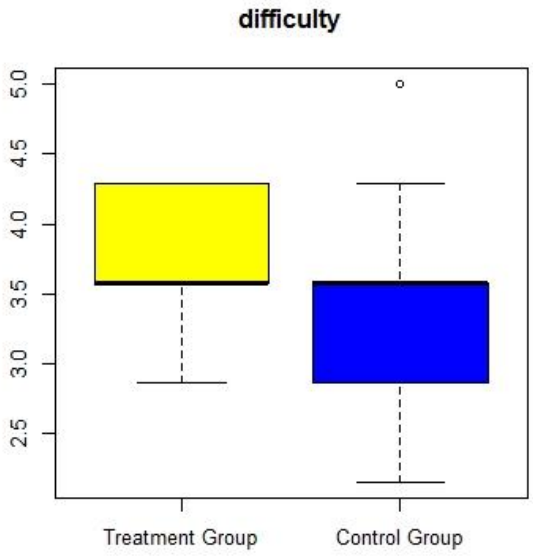




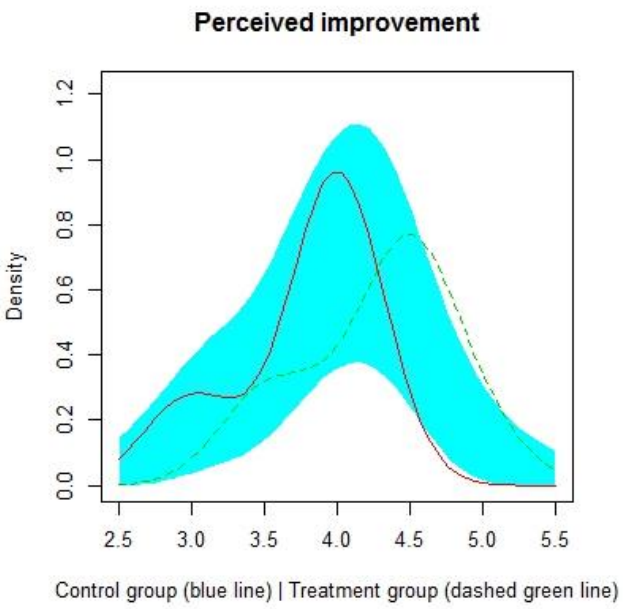


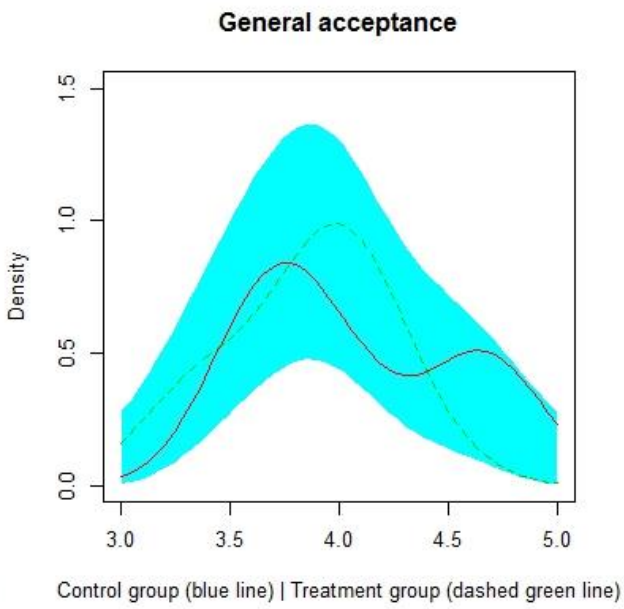

imageRole
4.5
4.0
3.5
3.0
2.5
2.0
Treatment Group
Control Group

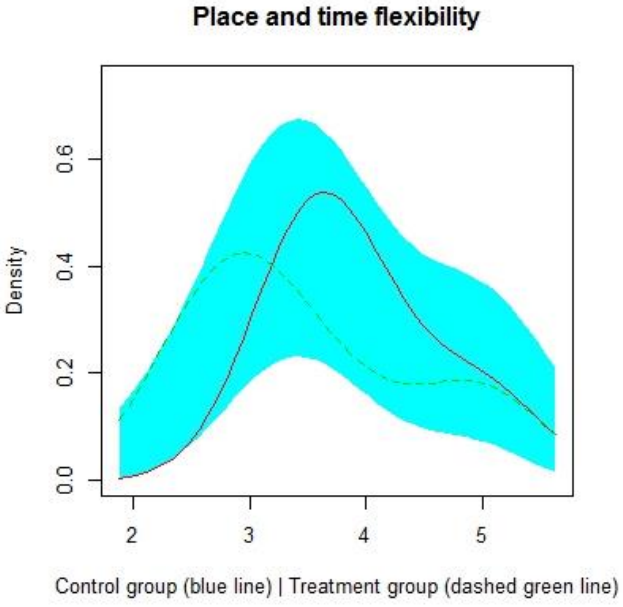

gamification
5.0
4.5
4.0
3.5
3.0
Treatment Group
Control Group

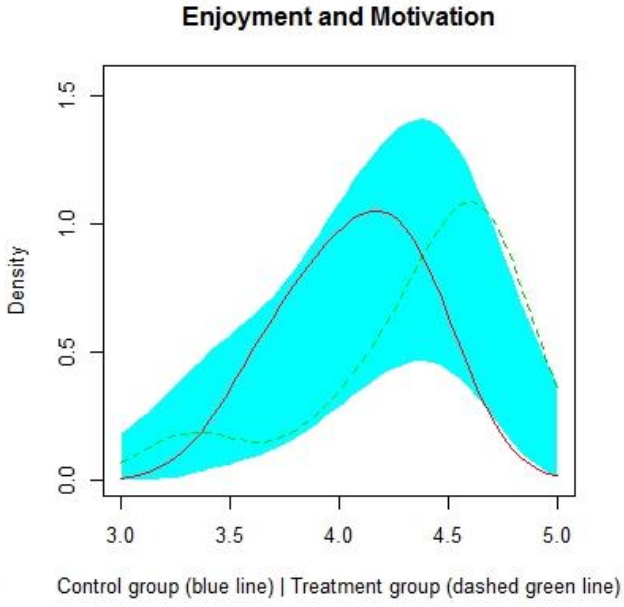

difficulty
5.0
4.5
4.0
3.5
3.0
2.5
Treatment Group
Control Group

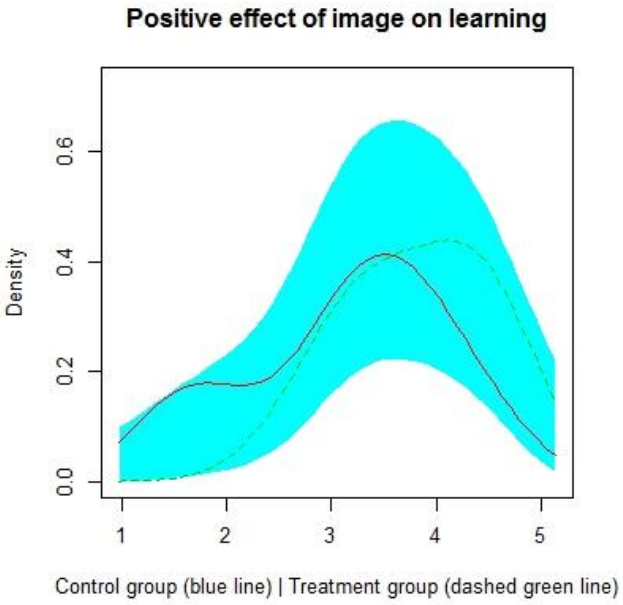
Comparison of univariate density estimates via bootstrapping and kernels

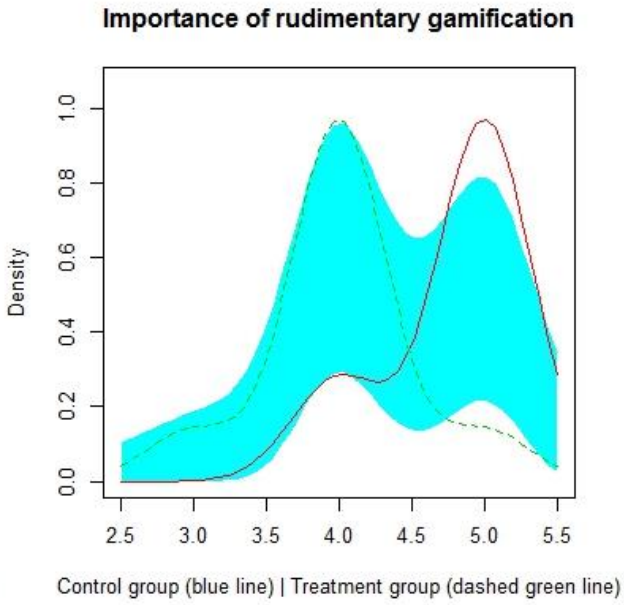


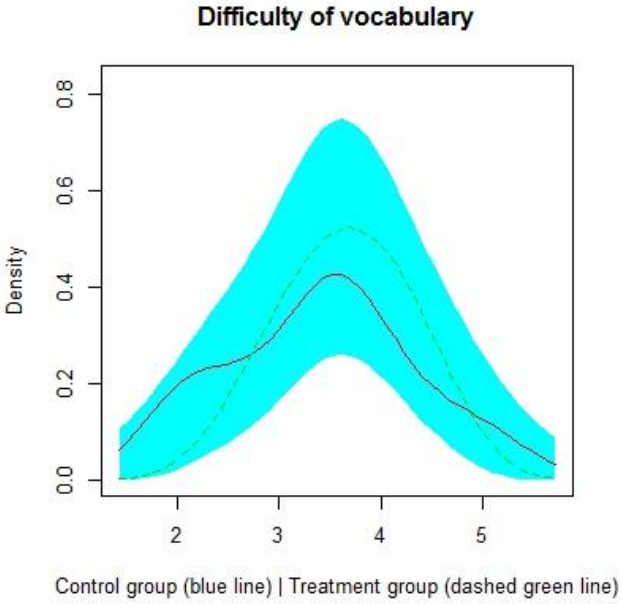












External factors and their effect on dependent variables

	Experience with mobile language learning applications	Spanish learner	Satisfaction with performance of smartphone device	Reached the end of the application's content	Experience with 9GAG	Difficulty
Perceived improvement	0,2822	0,9092	0,6892	0,4774	0,2687	0,8948
General Acceptance	0,6035	0,1150	0,8450	0,1426	0,2881	0,3104
Place and time	0,9233	0,9420	0,2822	0,2678	0,5870	0,0436

flexibility						
Motivation and enjoyment	0,6870	0,2128	0,2785	0,8969	0,3158	0,1058
Positive effect of image	0,6832	0,6999	0,6999	0,9869	0,8443	0,8443
Rudimentary gamification	0,7931	0,6913	0,1520	0,8327	0,9633	0,4301
Difficulty	0,7626	0,3552	0,3552	0,0298	0,8948	0,8948

Final comments of the participants at the end of the Final Evaluation Survey (free text)

Is there anything else you would like to share as an experience, recommendations, observation or general advice?
Treatment Group
The audio was way too low, therefore I was able to listen to very few of the phrases. After checking my phone audio-settings, the audio on the app remained very low.
Adding colour to what can be a repetitive task - learning words from a new language, is a useful and a welcomed addition. I think the application managed to do just that and I was pretty engaged while using it. There wasn't a boring moment throughout the process which I consider an advantage over other "drier" methods of learning. I was already aware of the running gags and I wasn't left wondering, so the overall progress was smooth. My recommendation is to have an exam of some sort after each section in order to grasp the meaning of the words better (I guess then you'd have to consider how that would affect the flow you would like to set). Overall, I believe Punny proved successful in allowing me to get to know a new language (which I hadn't considered before) in a funny and engaging way - I was always looking forward to the next chapter.
The Punny app seems like a very interesting concept to me. First of all, and to be very honest, I don't believe it can be the main language learning app. It lacks deeper language insight and information. Most of the answers I made were guesses based on context in images. Even though most of my answers were correct, I didn't necessarily understand why the sentence was constructed in some way, or why a particular verb had a specific ending. Having said that, I strongly believe it can be a very helpful secondary learning app. It can be very interesting when used together with Duolingo, or any other similar app, that mostly lack the fun part in learning. They concentrate more on explaining how the language works, but it's often boring.
While there are standard apps with images as cards, Punny's way seems more interesting and maybe more appealing to the new generations who are very used to meme type images.

Control Group

All and all I thought it was a good way to learn vocabulary. Sometimes I felt it was a bit too easy but that is the point of repetition I guess. It would be interesting to see how much I retain as that would really be the test of how well it worked.

All phrases must be arranged thematically and repeated in more situations. GIFs are also useful tools. Generally I like the idea and think it will have success. Keep going! :)

I like the method of learning but I disliked that I start directly with phrases. You can implement more basic things in order to gradually increase the level of complexity of the topics. It felt kind of like I am starting from the middle.

I think this app will be quite useful if new words repeated more often in different contexts

Hide the correct answer (i.e. the image in the slide-down component where the correct answer is situated) from the client (the browser) and only return it upon the AJAX call made to the server.
I also find the use of the same image to mark the correct answer a bit unsuitable. A green "Correct" or a couple of predefined phrases with the same meaning (say ["Right", "Exactly", "You nailed it"]) would be maybe better. Moreover, same image twice in couple of hundred of pixels means more "scrolling", especially on a mobile device.

In some ways, I find the application more useful than similar ones, which are already in the market. However, additional learning methods might be involved. Therefore, i am sure the user experience will be much better. Good Luck

I liked Punny. The only critical comment I can add is that I would like to have bigger variety of learning tools. Learning through the image is refreshing but it feels a little bit repetitive (as a learning tool) after a while. It would be nice if there are testing checkpoints (to measure my progress).

G. Google Analytics Data

Google Analytics

Punnyapp - http://beta.punnyapp.com/ Go to this report
All Web Site Data

Language

Jun 4, 2015 - Jun 6, 2015

All Sessions
100.00%

Explorer

Summary

	Mobile Device Info	Service Provider	Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
			13 % of Total: 14.94% (87)	61.54% Avg for View: 87.36% (-29.55%)	8 % of Total: 10.53% (76)	38.46% Avg for View: 88.51% (-56.54%)	3.15 Avg for View: 1.34 (134.52%)	00:07:36 Avg for View: 00:01:31 (401.18%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	$0.00 % of Total: 0.00% ($0.00)
1.	Apple iPhone	arcor ag	**3** (23.08%)	66.67%	2 (25.00%)	33.33%	4.67	00:08:48	0.00%	0 (0.00%)	$0.00 (0.00%)
2.	HTC PM63100 One X+	adsl korisnici crnogorskog telekoma	**2** (15.38%)	50.00%	1 (12.50%)	50.00%	3.00	00:05:40	0.00%	0 (0.00%)	$0.00 (0.00%)
3.	(not set)	deutsche telekom ag	**1** (7.69%)	100.00%	1 (12.50%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
4.	(not set)	university of cambridge	**1** (7.69%)	100.00%	1 (12.50%)	0.00%	3.00	00:11:55	0.00%	0 (0.00%)	$0.00 (0.00%)
5.	LG P70(Optimus L7	arcor ag	**1** (7.69%)	0.00%	0 (0.00%)	0.00%	2.00	00:01:09	0.00%	0 (0.00%)	$0.00 (0.00%)
6.	LG P70(Optimus L7	telefonica o2 (germany) gmbh & co. ohg	**1** (7.69%)	0.00%	0 (0.00%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
7.	Samsun_ GT-I8190 Galaxy S III Mini	telefonica germany gmbh & co. ohg	**1** (7.69%)	100.00%	1 (12.50%)	0.00%	4.00	00:19:06	0.00%	0 (0.00%)	$0.00 (0.00%)
8.	Samsun_ GT-I9300 Galaxy S III	arcor ag	**1** (7.69%)	100.00%	1 (12.50%)	0.00%	4.00	00:12:50	0.00%	0 (0.00%)	$0.00 (0.00%)
9.	Samsun_ GT-I9300 Galaxy S III	telefonica o2 (germany) gmbh & co. ohg	**1** (7.69%)	0.00%	0 (0.00%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
10.	Samsun_ SM-G850F Galaxy	vodafone d2 gmbh	**1** (7.69%)	100.00%	1 (12.50%)	0.00%	5.00	00:16:04	0.00%	0 (0.00%)	$0.00 (0.00%)

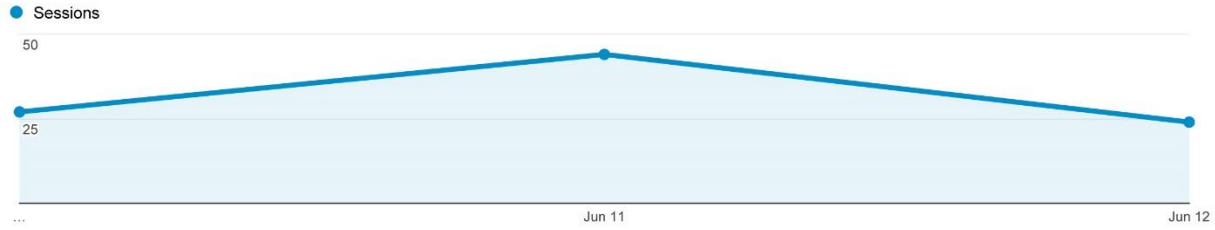
Language

Jun 10, 2015 - Jun 12, 2015

All Sessions
100.00%

Explorer

Summary



	Mobile Device Info	Service Provider	Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session	Avg. Session Duration	Goal Conversion Rate	Goal Completions	Goal Value
			19 % of Total: 20.00% (95)	47.37% Avg for View: 87.37% (-45.78%)	9 % of Total: 10.84% (83)	52.63% Avg for View: 85.26% (-38.27%)	2.79 Avg for View: 1.46 (90.65%)	00:03:17 Avg for View: 00:01:15 (161.83%)	0.00% Avg for View: 0.00% (0.00%)	0 % of Total: 0.00% (0)	$0.00 % of Total: 0.00% ($0.00)
1.	Apple iPhone	arcor ag	**3** (15.79%)	0.00%	0 (0.00%)	66.67%	2.00	00:02:05	0.00%	0 (0.00%)	$0.00 (0.00%)
2.	Apple iPhone	sprint nextel corporation	**3** (15.79%)	100.00%	3 (33.33%)	66.67%	2.00	00:03:35	0.00%	0 (0.00%)	$0.00 (0.00%)
3.	Apple iPhone	telekom deutschland gmbh	**3** (15.79%)	33.33%	1 (11.11%)	66.67%	1.67	00:00:59	0.00%	0 (0.00%)	$0.00 (0.00%)
4.	LG P700 Optimus L7	arcor ag	**2** (10.53%)	0.00%	0 (0.00%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
5.	(not set)	vodafone d2 gmbh	**1** (5.26%)	0.00%	0 (0.00%)	0.00%	2.00	00:00:36	0.00%	0 (0.00%)	$0.00 (0.00%)
6.	Apple iPhone	(not set)	**1** (5.26%)	100.00%	1 (11.11%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)
7.	Apple iPhone	medicom bulgaria ltd.	**1** (5.26%)	100.00%	1 (11.11%)	0.00%	6.00	00:03:18	0.00%	0 (0.00%)	$0.00 (0.00%)
8.	Apple iPhone	vodafone d2 gmbh	**1** (5.26%)	0.00%	0 (0.00%)	0.00%	8.00	00:09:46	0.00%	0 (0.00%)	$0.00 (0.00%)
9.	Motorc XT1039	ntl infrastructure - renfrew	**1** (5.26%)	0.00%	0 (0.00%)	0.00%	5.00	00:11:36	0.00%	0 (0.00%)	$0.00 (0.00%)
10.	Motorc XT1039	university of glasgow	**1** (5.26%)	100.00%	1 (11.11%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	$0.00 (0.00%)

Rows 1 - 10 of 12

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