

**Open University of Cyprus**

**Faculty of Pure and Applied Science**

**Master's Programme of Study**

*Cognitive Systems*

**Master's Dissertation**



**The impact of emotions on the memorization of new  
Chinese vocabulary words in online learning**

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**Supervisor**

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**May 2022**

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fulfilment of the requirements for the postgraduate degree

in Cognitive Systems

Faculty of Pure and Applied Science

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Finally, I dedicate the present MSc dissertation to the memory of my beloved cat co-author Captain Jack the Sparrow, whom I adopted when choosing the topic of my MT and who accidentally passed away in June, 2022 after my defense.

# Abstract

This study investigates the influence of positive and negative emotions on memorization of new vocabulary words in adults who learn Chinese online at the beginner's level. This study aims to determine whether emotionally colored words are better memorized than emotionally neutral words and also whether words related to negative emotions are memorized better than words related to positive emotions.

43 volunteers, who started to learn Chinese recently, were divided into three groups: two experimental groups (N=15 and N=15) and one control group (N=13). Every group was given an assignment to learn 20 new simple Chinese words in one week. According to their instructions, the participants of Experimental group 1 and Experimental group 2 had to memorize words, building a relation with a word from the list and a prescribed emotion. The participants of the control group were given the instruction to memorize the same 20 Chinese words using ordinary methods taken at their school or course.

The results showed that the words associated with the emotion "fear" are the most remembered. Among four investigated emotions, anger is at the second place with results, followed by interest, and joy is at the last place. Emotionally neutral words have a lower level of memorization than emotionally colored ones.

Recommendations for online courses or language learning applications or game developers are also provided.

# Περίληψη

Η παρούσα ερευνητική εργασία διερευνά την επίδραση των θετικών και αρνητικών συναισθημάτων στην απομνημόνευση νέων λέξεων λεξιλογίου σε ενήλικες που μαθαίνουν Κινέζικα διαδικτυακά σε επίπεδο αρχαρίων. Η εργασία έχει ως στόχο να προσδιορίσει εάν οι συναισθηματικά έγχρωμες λέξεις απομνημονεύονται καλύτερα από τις συναισθηματικά ουδέτερες λέξεις και εάν οι λέξεις που σχετίζονται με αρνητικά συναισθήματα απομνημονεύονται καλύτερα από τις λέξεις που σχετίζονται με θετικά συναισθήματα.

43 εθελοντές, που άρχισαν να μαθαίνουν κινέζικα πρόσφατα, χωρίστηκαν σε ομάδες: δύο πειραματικές ομάδες (N=15 και N=15) και μία ομάδα ελέγχου (N=13). Σε κάθε ομάδα δόθηκε μια εργασία να μάθει 20 νέες απλές κινεζικές λέξεις σε μια εβδομάδα. Σύμφωνα με τις οδηγίες τους, τα μέλη της πειραματικής ομάδας 1 και της πειραματικής ομάδας 2 έπρεπε να απομνημονεύσουν λέξεις, σχετίζοντας μια λέξη από τη λίστα με ένα προδιαγεγραμμένο συναίσθημα. Στα μέλη της ομάδας ελέγχου δόθηκε η οδηγία να απομνημονεύσουν τις ίδιες 20 κινεζικές λέξεις με συνηθισμένες μεθόδους του σχολείου ή των μαθημάτων τους.

Τα αποτελέσματα έδειξαν ότι οι λέξεις που σχετίζονται με το συναίσθημα «φόβος» θυμούνται περισσότερο. Μεταξύ των τεσσάρων συναισθημάτων που διερευνήθηκαν, ο θυμός βρίσκεται στη δεύτερη θέση, ακολουθείται από το ενδιαφέρον, και η χαρά είναι στην τελευταία θέση. Οι συναισθηματικά ουδέτερες λέξεις έχουν χαμηλότερο επίπεδο απομνημόνευσης από τις συναισθηματικά έγχρωμες.

Παρέχονται επίσης συστάσεις για διαδικτυακά μαθήματα ή εφαρμογές εκμάθησης γλωσσών ή προγραμματιστές παιχνιδιών.

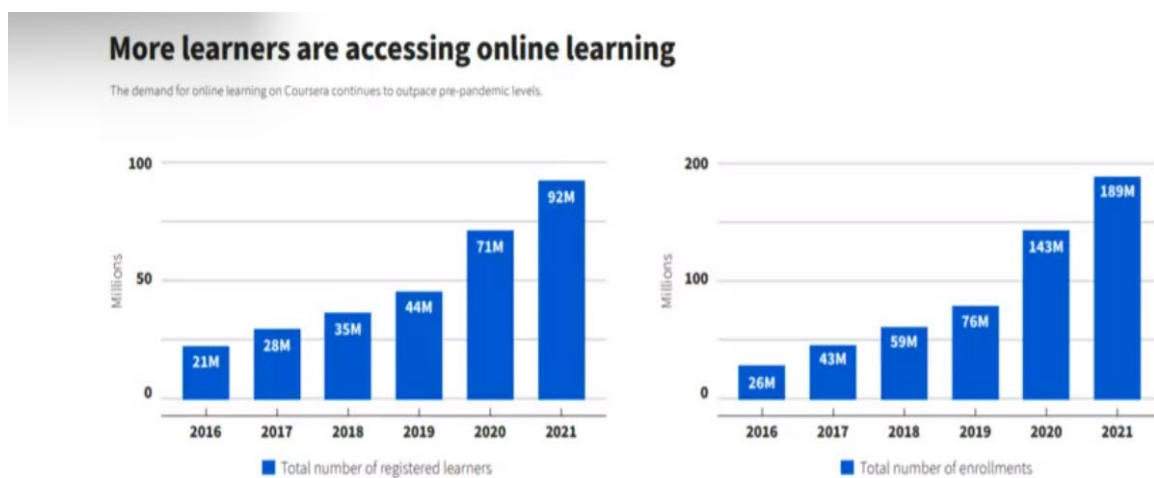
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# 1. Introduction

One of the advantages of online learning is the possibility for every student to choose the educational materials and methods of their presentation individually for themselves, according to their personal characteristics and preferences. So, a promising direction for modern research is to consider as many individual characteristics of learning as possible in order to give every particular student the opportunity to choose online study programs based on their strengths in the future.

**Figure 1.** Online learning has received a powerful boost in the era of the Covid-19 pandemic.



More than 20 million new learners registered for courses in 2021. Image: Coursera

The Chinese language is a good subject to explore various aspects of online learning. It affects all types of perception and types of human memory, because it contains tonal pronunciation, hieroglyphic writing of words and semantic constructions that are different from European ones.

China's economy has grown steadily, rapidly, and consistently for the past 40 years since the start of the reforms and opening up. The economic growth of China has become a hot topic in intellectual circles (Ding & Knight, 2011; Donald et al., 2018). Many of China's economic indicators have been considered among the best in the world, contributing significantly to global economic growth (Li & Wang, 2018; Zhang et al., 2012). China overtook the United States as the world's largest commodity exporter in 2009. In 2010, it overtook Japan as the world's second largest economy, and in 2012, it overtook the United States as the world's top commodity importer and exporter (Long &



Herrera, 2018; Lu et al., 2018). Then, in 2016, China overtook the United States as the world's second-largest capital exporter (Dwight, 2019).

The global diffusion of Chinese culture is growing year by year as China's economy rises fast (Xie, 2018). A growing number of people are learning Mandarin Chinese and speaking it (Li, 2019) after a 40-year period of steady, rapid, and consistent expansion.

As a result, learning and speaking Mandarin Chinese could become a popular trend in the upcoming decades. It will also be the sensible decision for people to maximize their personal interests if they learn Mandarin Chinese. Furthermore, as I previously said, the promotion of Mandarin Chinese on a global scale is accompanied by the increase in China's economic growth (Xie, 2021)

Because the new needs of users are radically different, more study findings will be necessary for all stakeholders and those responsible for various types of eLearning, hybrid learning, online learning, and so on. It must be taken into account that the new generation of users has a substantial impact (Pikhart, 2021).

Kosek and Lison (2014), for example, developed a model for learning Chinese that is constantly updated based on observations of the learner's behavior in the exercises and used at runtime to select the activities that are projected to maximize the learning outcome.

Having a wide range of expectations and failing to meet them would inevitably result in the failure of the entire ICT (information and communication technologies) sector. The practical ICT characteristics must be improved and made more visible, by incorporating AI into areas where it is not currently used as well.

However, it is still extremely noticeable. Following a brief systematic literature review, I will discuss the short experimental study I conducted, including all findings, implications, future recommendations for online language teachers, developers of language learning games and applications, and study limitations.

# 2. Literature review

## 2.1. Introduction

The controversy between emotions and cognition has long been a common place in Western philosophy (Rothermund & Koole, 2018). Cognitive theories were first applied to the scientific analysis of emotion in the late 1980s. The period until the late 1990s can be observed as a pioneering era for application of cognitive theories in the analysis of emotion. Over the last two decades, there has been a surge in research on the relationship between emotions and cognition (for a review see Kaakinen et al., 2018). From the 2000s, a rapid growth in the quantity of empirical research papers can be seen, especially in the field of automatic processing biases in clinical psychology. In recent 10-15 years, most of the works were related to self-regulatory processes in the emotional field. Emotions are engaged in judgement and decision-making, according to studies, and should thus be considered a part of cognitive functioning (Damasio, 1994; Frijda, 2010). I wanted to increase my understanding of how the valence (i.e., degree of pleasantness) and strength (i.e., degree of arousal) of the emotion transmitted by a text can influence the comprehension and memorization of the certain material.

## 2.2. Emotions and memory

Experiences that induce arousal are more likely to be recalled than experiences that do not elicit any emotional reaction, as has long been known. This improvement in emotional memory has been proven in a variety of paradigms and with a variety of stimuli (e.g., Bradley et al., 1992; Cahill & McGaugh, 1995; Kensinger et al., 2002). These improvements are especially noticeable for situations that stimulate arousal (e.g., Buchanan et al., 2004; Kensinger & Corkin, 2003; Talmi & Moscovitch, 2004), and it is thought that stress hormones may play a role in modifying these mnemonic influences.

Emotions are psychoneural processes that influence the intensity and patterning of behaviors in the dynamic flow of strong behavioral interchanges between animals and particular items that are essential for survival. As a result, each emotion has a distinct "feeling tone" that is particularly crucial in encoding the inherent values of these interactions, based on their likelihood of supporting or hindering survival (both in the immediate "personal" sense and in the long-term "reproductive" sense) (Tyng et al, 2017). Subjective experiential feelings are the result of interactions between various emotional

systems and the fundamental brain substrates of "the self," which are important for encoding new information, retrieving information on subsequent events, and allowing individuals to generalize new events and make decisions efficiently.

Arousal-mediated memory enhancement has been proposed to occur when there is an arousal-related increase in noradrenergic activation, leading to interactions between the basolateral nucleus of the amygdala and other regions important for sensory and mnemonic processing, as well as the release of glucocorticoids (reviewed by McGaugh, 2004; Wolf, 2009). Though it was often thought that such effects would be too slow to affect memory on a trial-by-trial basis, evidence is mounting indicating arousal-mediated enhancement is likely to occur even when the transition between emotional and neutral stimuli is very rapid.

According to Osaka et al., 2011, although negative and positive emotions play an important role in working memory, little is known about the brain mechanisms that underpin emotional processing.

The reading span test (RST) was used by researchers (Osaka et al., 2011) to study the issue in terms of executive function, in which participants were required to read/understand a phrase while simultaneously memorizing a target word inside a text.

The negative RST resulted in lower accuracy, whereas the positive RST resulted in higher accuracy. fMRI data revealed strong activations in the right amygdala and right parahippocampal gyrus during the reading phase. However, parahippocampal activity occurred after amygdala activation had reduced.

The amygdala was activated during the recognition phase, when only neutral words were offered. In contrast to the control condition, we identified considerable activation in the substantia nigra during the positive-RST (reading phase). Activation in the left dorsolateral prefrontal cortex (DLPFC) increased during the recognition phase.

According to the findings of Osaka et al., negative emotions increased amygdala activity and disrupted attentional control in the executive function of working memory. Positive emotions, on the other hand, increased activity in the substantia nigra, which may have induced the dopaminergic response and hastened attentional maintenance, promoting activation in the left DLPFC.

## **2.3. Negative emotions, stress hormones and working memory**

Emotional stimuli's effect on working memory (WM) performance has yielded mixed results. In the literature, there is evidence of both emotion-dependent facilitation and impairment. Emotional modulation did not alter WM, according to Gyurak, Goodkind, Kramer, Miller, and Levenson (2012).

In terms of the association between negative emotions and WM, this study discovered that none of the emotions studied had an effect on WM. This discovery contradicts a recent finding that WM capability influences cognition–emotion connections (Strauss et al., 2012). However, it's plausible that emotion has an indirect impact on WM via certain brain activities. Cahill and McGaugh (1998) postulated a memory-modulating mechanism in which emotionally stimulating memories are stored in numerous brain regions with little or no involvement of stress hormone activation or the amygdaloid complex (AC). Stress hormone systems may interact with the AC during moments of emotional arousal to affect memory store mechanisms in other brain regions. As a result, it would be fascinating to see whether more research could be done to see that. During the periods of emotional arousal, stress hormone systems may interact with the AC to modulate memory storage processes occurring in other brain regions. In game-based circumstances, similar emotion–brain interactions can be found. Accordingly, it would be interesting to further investigate whether such emotion–brain interactions are found in game-based situations.

This instance demonstrates how CHL schools worked to ease the emotional and mental stress experienced by their students as a result of school closure and social isolation. As a result, they began offering entertaining courses while remaining committed to their purpose of teaching the ancestral language. In some ways, the schools attempted to address issues of well-being directly among its members by establishing such enjoyable and innovative heritage language classes during this challenging period.

This is especially true because schools used such engaging courses to lift students' spirits and enliven their daily lives while they were on lockdown and subjected to social isolation. Furthermore, such efforts are designed to provide kids with a sense of accomplishment by allowing them to make academic progress even while their regular schools are closed.

Many previous studies compared neutral stimuli to either negative or positive ones, but rarely both of them, and results with one valence (e.g., negativity) were frequently extrapolated to the other valence (e.g., positivity) without testing this assumption (Adelman et al., 2013). The effect of emotional stimuli on WM performance has yielded mixed results. In the literature, both emotion-dependent facilitation and impairment have been described. Gyurak, Goodkind, Kramer, Miller, and Levenson (2012), for example, discovered that emotional modulation had no effect on WM.

Lindstrom and Bohlin (2011) employed a modified visual 2-back task with high-arousal positive, high-arousal negative, and low-arousal neutral stimuli and showed that the arousing emotional stimuli aided WM performance in terms of response accuracy and reaction times when compared to the neutral stimuli. Gray (2001) discovered that a withdrawal-motivated unpleasant emotional state improved spatial working memory performance. These findings imply that strongly aroused negative emotions may have an impact on WM performance, but the direction of that influence has to be investigated further.

Stress hormones like noradrenaline (NA) and cortisol, on the other hand, have been shown to affect memory (Tollenaar, Elzinga, Spinhoven, & Everaerd, 2009). Cortisol has been demonstrated to impede memory retrieval (de Quervain, Roozendaal, Nitsch, McGaugh, & Hock, 2000). Aerial and functional MRI investigations back up the idea that acute and persistent psychological stress impairs WM. For example, Liston, McEwen, and Casey (2009) discovered that medical students who had stressful tests had reduced prefrontal functional connectivity. However, it has been proposed that corticosteroid hormones generated by the adrenal cortex buffer the brain from negative experiences and are necessary for cognitive performance (Cahill & McGaugh, 1998; de Kloet, Oitzl, & Joels, 1999).

Some researchers have provided evidence supporting the positive relationship between stress (hormones) and WM from the perspective of attention. Stress hormones, according to Joels, Pu, Wiegert, Oitzl, and Krugers (2006), can generate focused attention and boost retention of relevant information. Because the impact of stressors on cognitive performance varies depending on the severity and type of stress (Byron, Khazanchi, & Nazarian, 2010), and because the effects of negative emotions and stress hormones on WM are still debated, their study has shown that during gaming, highly activated negative emotions will have an impact on WM and WM will be influenced by stress hormones during gaming.

Negative information is recalled better in long-term memory than neutral information. This emotional memory augmentation could be due to differences in working memory processes (Kensinger, E. A., & Corkin, S., 2003).

Kensinger (2009) claims that understanding the impact of negative emotion on detailed recall could one day save our lives by guiding our behaviors and allowing us to plan for comparable future events. "Within an evolutionary context, these benefits make sense," Kensinger adds. "It's only natural that attention would be drawn to potentially dangerous information."

Positive affect frequently has minimal effect on memory accuracy, whereas negative affect is more likely to lead to focal memory enhancements, concludes Kensinger, 2009.

Emotional stimulation causes students to care profoundly about their studies, which can help in the development of multimodal literacy (Steele 2017, 212; see also Hutchison et al. (2021).

Observations in ordinary life show that facts and events connected with strong emotions are recalled better than those associated with a lack of emotional richness.

Individuals with flashbulb memories retain a strong, almost photographic memory of an emotional occurrence (Brown & Kulik, 1977; Heuer & Reisberg, 1990; Neisser & Harsch, 1992; Rubin & Kozin, 1984). Although flashbulb memories are produced infrequently, everyday encounters are frequently imbued with emotional significance. These emotional autobiographical recollections are more likely to be remembered than non-emotional autobiographical events. Furthermore, people often believe they remember these experiences in greater detail and vividness than situations with no emotional significance (Conway, 1990; Pillemer, Rhinehart, & White, 1986).

## **2.4. Emotions and language learning**

Since the 1970s, second language acquisition (SLA) researchers have been studying affect and emotions, mostly negative ones like language anxiety. The first studies on the effects of anxiety on SLA (Chastain, 1975; Kleinmann, 1977) yielded contradictory results, which Scovel (1978) attributed to the fact that "anxiety is neither a simple nor well-understood psychological construct, and it is perhaps premature to attempt to relate it to the global and comprehensive task of language acquisition".

Emotional states have long been known to influence cognitive performance (Drevets and Raichle, 1998). Several studies, on the other hand, have found that cognitive activity has a considerable impact on emotional states (e.g. Beauregard et al., 2001). The impact of good and negative mood on cognitive function was studied by Bartolic et al. (1999). During positive affect, data showed significantly better verbal working memory performance, as well as a considerable decline in verbal task performance. Gray (2001) found the same thing. As a result, emotional–cognitive relationships are not only visible but also practical.

In the domain of second language acquisition (SLA), the involvement of emotions in second language (L2) learning is a well-known but understudied phenomenon (Dörnyei, 2009; MacIntyre & Robinson, 2002; Swain, 2013). Many researchers are aware that emotions can have an impact on complex cognitive abilities (Storbeck & Maswood, 2016) and learning (Storbeck & Maswood, 2016, Dewaele et al., 2018; Khajavy et al, 2018; MacIntyre & Gregersen, 2012; MacIntyre & Vincze, 2017)

In the first language, emotional words are recalled better than neutral words. Using an encoding task focusing on emotionality, Ferré, Garca, Fraga, Sánchez-Casas, and Molero (2010) discovered this emotional effect also for second language terms.

Psychologists have looked into whether S-T terms in the L1 stand out from neutral words. Using profane or prohibited terms from spoken French, Lieury et al. (1997) studied the function of emotion in word memory. Short- and long-term recall experiments found that words having emotional significance were remembered better than neutral terms. The effect was strongest for vulgar/taboo terms (four times larger in long-term recall than neutral words).

Despite the fact that emotions play an important role in our lives, second language acquisition (SLA) experts have generally ignored them, according to Dörnyei and Ryan (2015). The authors link this to the field's cognitivist background and believe that it is past time for SLA research to overcome its overall "emotional deficiency." They want to know how we may "incorporate positive emotions more effectively into our accounts of learner psychology" as researchers.

This statement acknowledges that the role of positive emotions, while vaguely recognized in the field, still has a long way to go before it is given the respect it deserves (Dulay & Burt, 1977, Gardner, 1985; Krashen, 1982; Schumann, 1978), but it is also true that it has remained somewhat in the shadows of the vibrant research into negative emotions, primarily foreign language anxiety. Positive Psychology, the scientific study of

how individuals thrive and flourish in language pleasure (FLE), may be changing the situation (Dewaele & MacIntyre, 2014, 2016; Dewaele, MacIntyre, Boudreau, & Dewaele, 2016).

Foreign languages are often acquired in emotionally neutral academic situations, whereas native languages are acquired in emotionally rich circumstances. It has been proposed that bilinguals' emotional reaction in foreign-language circumstances is lower than in native language contexts as a result of this difference. Ivaz et al., 2016 in their investigation intended to see if the emotional distance associated with learning a foreign language could affect instinctive reactions to self-related linguistic stimuli. When compared to non-self-related stimuli, self-related stimuli improve performance by improving memory, speed, and accuracy (the so-called self-bias effect).

The ability to acquire and remember vocabulary is one of the most fundamental aspects of mastering any language. In the experiment of Do, H-D., Wen, J-M. & Huang, Sh-K. (2021), humorous films and the echo approach both produce excellent outcomes. Students in the experimental groups score much higher in vocabulary post-trial than students in the control groups.

## **2.5. Emotions in online learning**

Various educators and researchers have discovered that there are many elements that influence online learning, including individual characteristics like motivation and attitudes (Hew & Cheung, 2014), as well as social-environmental ones like interaction level (Dennen et al., 2007). Learner-learner interaction, learner-instructor interaction, and learner-content interaction are the three types of interactions identified by Moore (1989).

Learner-learner interaction refers to two-way contact between students, such as exchanging ideas with classmates, debating topics with one another, and receiving feedback from others. Learner-instructor interaction (Bernard et al., 2009) refers to two-way contact between students and instructors, such as asking questions, providing support, and encouraging pupils. Learner-content interaction refers to the flow of information from course content to students, such as course materials that assist students in actively making sense of the subject. Positive engagement, according to transactional distance theory (Moore, 1993), plays a significant role in lowering the possibility for misunderstanding caused by psychological and communicative distance in online learning.



Learners who engage in interaction are more likely to undertake effective educational transactions, according to transactional distance theory, and thus may benefit from online learning (Gokool-Ramdoe, 2008; Gopal et al., 2021). Similarly, the person-environment interaction model proposed that interactions between learners and their learning environment are a significant element in influencing learning behaviors like learning engagement (Neufeld et al., 2006).

# 3. Methodology

## 3.1. The study

### 3.1.1. Participants

The participants were all adults, learning Chinese at beginner's level in different online schools or with online teachers individually or in small groups. Before the experiment their level of Chinese language wasn't tested by me, it was tested by their schools or teachers and I accepted the results. Overall 43 participants took part in the experiment. There were 60 percent women and 40 percent men, the average age of participants was 38 years. The youngest participant was 27 and the oldest – 55 years old. 9 participants were from Greece and Cyprus with Greek as their native language, 1 participant from Peru with Spanish as native language, 1 participant from Iceland with Icelandic as native language, one participant from France with two native languages, French and Arabic, and 30 participants from Russia with Russian as their native language.

There were four main sources of participants:

- Online school of Chinese language “Chinese with the Master” («Китайский с магистром») based in Russia. The special feature of this school is hobby courses for lovers of Chinese doramas (series) and traditional Chinese culture;
- A group for expats, located in China, on Chinese social network “WeChat”;
- A Facebook group of OUC students;
- A chat about learning Chinese on Telegram messenger.

Over 200 participants have confirmed their desire to take part in the experiment and received the assignment, but only 42 of them have completed the task to the end and passed the final test.

### 3.1.2. Requirements for the level of training of participants

Each participant of the experimental or control group must have the basic skills of learning Chinese words:

- Four tones;
- Rules of reading syllabi in pinyin (5 rules);
- Chinese characters stroke order (8 rules).

The principal condition for participation was to study Chinese online, not at school or with a private offline teacher. I agreed with each participant that 20 new Chinese words

would be their only Chinese assignment for the week. Some participants in Russia performed the task during multi-day holidays, when online schools didn't work.

### **3.1.3. Experimental ethics**

The aim for the participants of our experiment was to memorize 20 new Chinese words in a week – a written character, pinyin transcription, tonal pronunciation and meaning. Participation was voluntary, every participant was informed that it's not a language test, they wouldn't be graded, no one can fail the assignment, there's no competition or comparison with other people, and the main value of the work was to explore the most effective ways of everyone's personal memorization and to help other people to memorize new information better.

The participants also were warned that the experiment implied deep inner emotional work and they were free to stop the experiment any time they felt uncomfortable.

### **3.1.4. Instruction given to participants of the experimental group:**

Here you can see 20 Chinese words. Your aim is to memorize them in a week. You are allowed to participate in the experiment only in case that all the words in the list are new for you

Read the words in the left column.

Come up with a story or draw a small picture in which each word from column 1 will be associated with those emotions marked by + in columns 2, 3, 4 or 5. Try not to use words and verbal thinking in your native language while creating the association between a Chinese word and an emotion – use gestures, body expression or images.

Example: "Porridge-Anger". Disgrace, we were again served this vile porridge for breakfast! It is impossible to eat.

Try to memorize each new word based on the emotion associated with it. In a week I will send a test with which you can assess the strength of memorization of the four components of each word: hieroglyph, pinyin, tones and meaning.

Two experimental groups were recruited, the difference in assignments between them was the correlation of words and emotions. For example, the word "porridge" in the first group is related to anger and in the second – to joy. For more detailed instruction see Appendix A.

### 3.1.5. Instruction given to the control group:

You are allowed to participate in the experiment only in case that all the words in the list are new for you.

Learn all the words in the list in a week. You are free to use any method of memorizing and learning. If you need help, for example, in pronunciation, you are welcome to receive help from your current Chinese teacher or from other teachers in my contact list.

After a week, I'll send you a test to control your memorization.

Your aim is to learn four options for every word: written character, pinyin, tone and meaning.

#### **Words were the following:**

(tones are marked by numbers – 1,2,3,4)

1. 粥 zhou1 porridge
2. 雷 lei2 thunder
3. 土 tu3 earth
4. 石 shi2 stone
5. 星 xing1 star
6. 坏 huai4 bad
7. 姜 jiang1 ginger
8. 弱 ruo4 weak
9. 瘦 shou4 thin
10. 胖 pang4 fat
11. 鱼 yu2 fish
12. 田 tian2 field
13. 狗 gou3 dog
14. 菜 cai4 vegetable
15. 汤 tang1 soup
16. 火 huo3 fire
17. 毛 mao2 hair
18. 面 mian4 noodles
19. 米 mi3 rice

20. 虎 hu3 tiger

**Principles of choosing words for the experimental assignment** – every word must be new for beginners, not learned at the first lesson such as “nihao” (hello). So all the words on the list are not frequently used, but easy enough for beginners – every word consists of one syllable (in Chinese one syllable can contain two vowel sounds such as “mian”), is written with one character and has clear meaning.

**Principles of choosing emotions for the experimental assignment** – we consider four human emotions: two positive (joy and interest) and two negative (anger and fear). They all are basic human emotions, easy to express by facial mimics, body language or voice.

### **3.2. The experimental process**

Data was collected twice, before and after the new words learning instruction for both the experimental and the control group.

Before participating in the experiment, the volunteers were asked to prove the following statements:

- I am over 18 years old;
- All the words from the proposed list are new to me;
- I am familiar with the basic rules of pronunciation syllables and writing characters in Chinese;
- I’m learning Chinese online, not with a teacher or at an offline school;
- I am ready to participate in the experiment voluntarily.

Only those who answered "yes" to all questions were allowed to participate in the experiment. During the final quiz, the participants were asked the following questions:

- Your name and gender identity (without personal data such as family name, for example – Anna, female);
- Your exact age (not just “over 18”);
- Your native language.

Actually, the test in which it was necessary to value the level of memorization of each of the twenty words in one week.

Only 2 participants asked me for help in completing the task. One person was in doubt how to make a connection between the word “bad” (坏, huai4) and an emotion “joy”. I offered him to imagine something bad and then – a situation, in which something he considers as bad didn’t happen or don’t exist, that’s why he feels joy. The participant was satisfied with my answer and fulfilled the assignment. Another participant of the experiment wrote to me that she had never tasted ginger and didn’t know what it was, as in the area where she lives, they don’t grow and eat ginger. Her task was to associate ginger with fear, and I offered her to feel the situation in which she has to taste an unfamiliar product - for example, in China.

Each of the 30 participants in 2 experimental groups was asked to choose to express an emotion nonverbally or to draw a picture related to a fictional situation, but no one chose a picture - everyone preferred the first option. At the end of the experiment, the participants were given a final test. Here is an example of assessing the quality of memorization of one word, for all 20 words the questions were the same (see Fig. 2). Examples of associating a word with an emotion can be found in the Appendix B.

**Figure 2.** Multiple choice in the final quiz.

Word 2 雷 \*

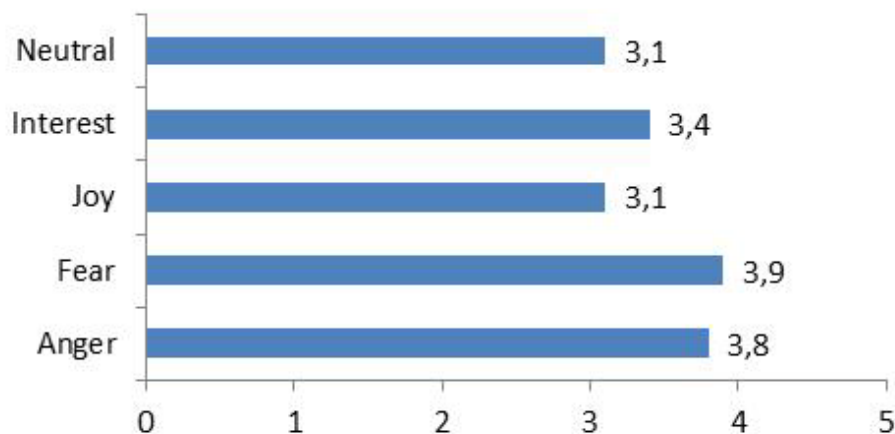
- I remember this word perfectly.
- I don't remember some option - character, pinyin, tone or meaning.
- I remember this word 50/50.
- I remember only 1 option.
- I can hardly recognize it.

# 4. Results and discussion

## 4.1. Descriptive statistics

All the results of the final test were summarized in a table, where they were distributed according to the emotions associated with the memorization of words for each user. See Fig. 3

**Figure 2.** Test results of memorization for each emotion and neutral words.



Regarding the final quiz, the t-test results showed that received data can be considered statistically significant ( $p=0,000131$ ,  $p<0.05$ ). These values were obtained by comparing the arithmetic mean score of all experimental groups, where words were memorized in conjunction with emotions, and in the control group, where neutral words were memorized.

Then the t-test showed comparisons of the results of memorizing neutral words in the control group and the words associated with each individual emotion in the experimental groups, see Fig.4.

**Figure 3.** The significance of the difference in the results of memorizing emotionally colored and neutral words.

<b>Emotion</b>	<b>t-test results in comparison with results in neutral words</b>	<b>Significant or not</b>
Anger	p=0.0000189	p<0.05
Fear	p=0.00000269	p<0.05
Joy	p=0.640184	p>0.05
Interest	p=0.029069	p<0.05

The t-test results showed that the difference in the results for the memorization of words, related to the emotion of “joy” in comparison to neutral words is insignificant. In addition, the participants of two experimental groups, whose task was to memorize new Chinese vocabulary words in relation to joy, rated their results with the highest or lowest score - 5 or 1, while the quality of remembering words associated with other emotions was most often rated at 4, 3 or 2.

## **4.2. Normality test**

The validity of the difference between the empirical distributions and the theoretical normal distribution was tested using the Kolmogorov-Smirnov test. Differences were considered significant (significant) at p-level  $\leq 0.5$ . The results of the check can be seen in Fig. 5. For the control group, the test was not carried out due to the small sample size. Therefore, non-parametric criteria were used to compare the data with those from the control group.

For the Negative variable, a significant difference was obtained between the empirical distribution and the theoretical normal distribution, however, during the analysis of statistical outliers, it was shown that the data of study participant #9 do not belong to the distribution of values for this variable, and therefore there was no reason to include his results for the Negative variable in the analysis data.



**Figure 4.** Results of checking the reliability of the difference between empirical distributions and the theoretical normal (after estimating statistical outliers).

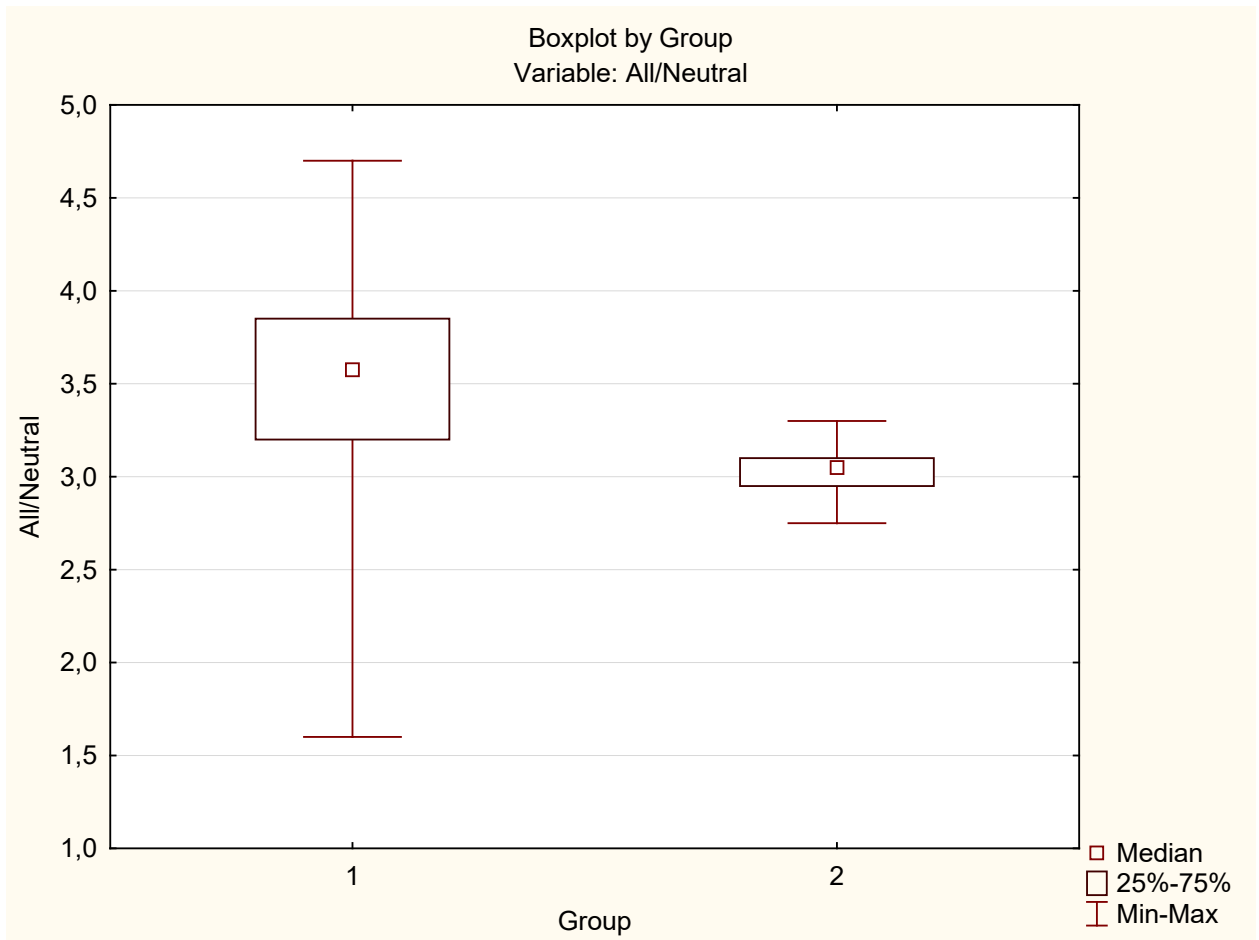
<b>Variables</b>	<b>d</b>	<b>p</b>
Fear	.137	>.2
Anger	.155	>.2
Joy	.137	>.2
Interest	.151	>.2
Negative	.141	>.2
Positive	.095	>.2
All emotions	.144	>.2

Note.: d is the value of the Kolmogorov-Smirnov statistics, p is the significance level.

As it was shown that for the experimental group the requirement of normal distribution is observed, for processing the data of the control group there were reasons to apply parametric processing criteria.

I compared the mean values of success in reproducing the spelling of 20 Chinese words in two groups according to the Mann-Whitney test (exact Mann-Whitney test). Reproduction success was shown to be significantly lower in the control group ( $U = 64.0$ ,  $p = .0002$ ). Graphic display of the received results see in Fig. 6.

**Figure 5.** Boxplot showing comparison of experimental (1) and control (2) groups.

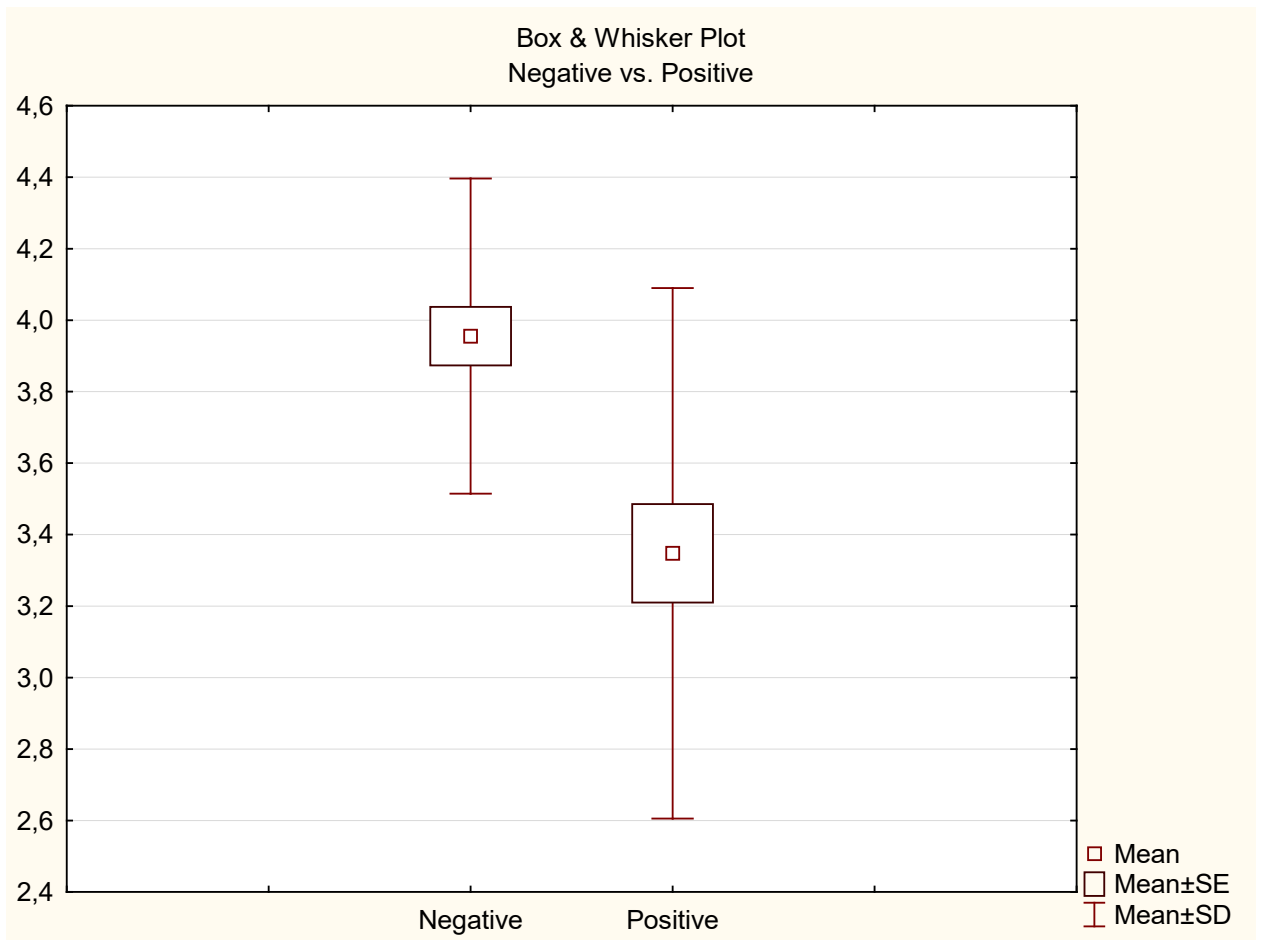


The Z-value (Z-score) is not given due to the fact that an exact, not an asymptotic, test was used.

Then I analyzed the difference between the four emotional contexts. As the distribution of indicators does not differ from the normal curve, the analysis of variance with repeated measures (ANOVA with repeated measures) was used. Emotional contexts were shown to be significantly different from each other ( $F = 15.35$ ,  $p = .00004$ ). We can say that the success of reproducing the spelling of words is higher in the contexts of Fear (3.99) and Anger (3.73), lower in the context of Interest (3.43) and minimally in the context of Joy (3.16).

The differences between the contexts of negative and positive emotions were analyzed using Student's t-test for dependent samples. It was shown that there are significant differences: reproducibility in the case of a negative context is higher ( $M = 3.95$ ) than in the case of a positive one ( $M = 3.34$ ) ( $t = 4.58$ ,  $df = 28$ ,  $p = .000085$ ). For a graphical representation of the distributions, see fig. 7

**Figure 6.** Boxplot showing comparison of negative and positive contexts



### **4.3. Discussion**

In this study, I considered the influence of negative and positive emotions on memorization of Chinese words.

My first hypothesis was that emotionally colored words are memorized more successfully than emotionally neutral ones. My second hypothesis was that words related to negative emotions are memorized better than words colored with positive emotions. H1 is based on the research of Kensinger & Corkin (2003) where the authors found that negative information is recalled better in long-term memory than neutral information. H1 also has background in earlier findings of Brown & Kulik, 1977; Heuer & Reisberg, 1990; Neisser & Harsch, 1992; Rubin & Kozin, 1984, who came to the conclusion that emotional autobiographical recollections are more likely to be remembered than non-emotional autobiographical events.

H2 is based on the conclusion of Kensinger's (2009) view of D'Mello et al. (2014) and other researchers. "Positive affect frequently has minimal effect on memory accuracy, whereas negative affect is more likely to lead to focal memory enhancements" – Kensinger underlines.

My hypothesis was also grounded on the plethora of earlier scientific research. Individuals with flashbulb memories retain a strong, almost photographic memory of an emotional occurrence (Brown & Kulik, 1977; Heuer & Reisberg, 1990; Neisser & Harsch, 1992; Rubin & Kozin, 1984). Although flashbulb memories are produced infrequently, everyday encounters are frequently imbued with emotional significance. These emotional autobiographical recollections are more likely to be remembered than non-emotional autobiographical events. Furthermore, people often believe they remember these experiences in greater detail and vividness than situations with no emotional significance (Conway, 1990; Pillemer, Rhinehart, & White, 1986).

The results of the experiment showed that its participants best remembered the words associated with the emotion "fear". Among four investigated emotions, anger is at the second place with results, followed by interest, and joy is at the last place. Emotionally neutral words have a lower level of memorization than emotionally colored ones.

### **4.4. Limitations**

Honesty of participants played an important role. I also had no possibility to control emotions of participants using positron emission tomography (PET), electroencephalography (EEG), fMRI, blood tests for hormone level or AI-equipped face

emotion recognition as did many researchers whose work I cited in the literature review. I also couldn't use directive hypnosis to inspire the participants with certain emotions, as some researchers did, for example.

# 5. Recommendations

The experimental process has shown that different participants have very different language learning preferences. Some prefer emotional and gamified material, while others prefer monotony and daily repetition. And this does not mean that the most pleasant way for the certain student will be the most effective for him/her. For example, in my experiment, there were 8 participants who initially responded that they did not want to deal with negative emotions such as anger and fear, then reluctantly agreed to try to memorize words in conjunction with negative emotions, and in the process, it turned out that negative emotions were tolerable, and words in emotional scenes are remembered better than in neutral ones.

Numerous studies have found a variety of factors as well as individual variances in emotional processing. Personality qualities (Montag and Panksepp, 2017), intellectual capacity (Brackett et al., 2004), and gender are only a few examples (Cahill, 2003). Furthermore, sex hormones and personality factors (e.g., extraversion and neuroticism) appear to modulate emotional processing as well as influence individual responses to emotional stimuli. Appropriate screening using psychological testing, as well as gender balancing experimental cohorts, can help to reduce erroneous results due to individual differences.

The study of the influence of emotions on the memorization of new foreign words can form the basis for the development of a test that will help to determine the preferences of each individual in learning foreign languages in the same way that artificial intelligence does now, offering new films, music albums or courses to the users after the analysis of his/ her future preferences and the things that aroused some interest.

Nowadays, entertainment and online education fields are developing separately. For example, many participants of my experiment have been playing a game for several years, which was based on Chinese mythology where you have to appease the fierce dead by casting spells. But in online Chinese classes, they use rote learning, although a game could be developed, with new learned material having to be necessary as an instrument to appease the fierce dead.

Cognition and emotion have long been viewed as enemies in Western philosophy. Now, in connection with the latest research and discoveries in the field of neuroscience, this point of view is being increasingly revised, and this opens up new opportunities for learning gamification, including more emotional material in courses.



# References

- Adelman, J. C. & Estes, Z. (2013). Emotion and memory: A recognition advantage for positive and negative words independent of arousal, *Cognition*, Volume 129, Issue 3, 2013, Pages 530-535, ISSN 0010-0277, <https://doi.org/10.1016/j.cognition.2013.08.014>.
- Bartolic, E.I., Basso, M.R., Schefft, B.K., Glauser, T., Titanic-Schefft, M. (1999) Effects of experimentally-induced emotional states on frontal lobe cognitive task performance. *Neuropsychologia*. Jun;37(6):677-83. doi: 10.1016/s0028-3932(98)00123-7. PMID: 10390029.
- Beauregard M, Lévesque J, Bourgouin P. Neural correlates of conscious self-regulation of emotion. *J Neurosci*. 2001 Sep 15;21(18):RC165. doi: 10.1523/JNEUROSCI.21-18-j0001.2001. PMID: 11549754; PMCID: PMC6763007.
- Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A Meta-Analysis of Three Types of Interaction Treatments in Distance Education. *Review of Educational Research*, 79(3), 1243–1289. <http://www.jstor.org/stable/40469094>
- Bowen, H. J., Kark, S. M. & Kensinger, E.A. (2018). NEVER forget: negative emotional valence enhances recapitulation. *Psychon Bull Rev* 25, 870–891 (2018). <https://doi.org/10.3758/s13423-017-1313-9>
- Brackett, M. A., Mayer, J. D., & Warner, R. M. (2004). Emotional intelligence and its relation to everyday behaviour. *Pers. Individ. Dif.* 36, 1387–1402. doi: 10.1016/S0191-8869(03)00236
- Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering Pictures. Pleasure and arousal in memory: *Journal of Experimental Psychology: Learning Memory and Cognition*, 18, 379 – 390
- Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition*, 5, 73-99.
- Buchanan, T. S., Lloyd, D. G., Manal, K., & Besier, T. F. (2004). Neuromusculoskeletal modeling: estimation of muscle forces and joint moments and movements from measurements of neural command. *Journal of applied biomechanics*, 20(4), 367–395. <https://doi.org/10.1123/jab.20.4.367>
- Byron, K., Khazanchi, S., & Nazarian, D. (2010). The relationship between stressors and creativity: A meta-analysis examining competing theoretical models. *Journal of Applied Psychology*, 95(1), 201–212. <https://doi.org/10.1037/a0017868>



- & McGaugh, J. L. (1995). A novel demonstration of enhanced memory associated with emotional arousal. *Consciousness and cognition* 4 (4), 410-421
- Cahill, L., & McGaugh, J. L. (1998). Mechanisms of emotional arousal and lasting declarative memory. *Trends Neurosci.* 21, 294–299. doi: 10.1016/S0166-2236(97)01214-9
- Chastain, K. (2006). Affective and Ability Factors in Second Language Learning. *Language Learning*. 25. 153 - 161. 10.1111/j.1467-1770.1975.tb00115.x. Conway, 1990
- Craig, S. D., & Graesser, A.C. (2003). Why am I confused: An exploratory look into the role of affect in learning. *Advances in Technology-based Education: Towards a Knowledge-based Society*. 3. 1903-1906.
- Damasio, A. R. (1994). *Descartes' Error: Emotion Reason, and the Human Brain*. New York: Avon Books.
- D'Mello, S., Lehman, B., Pekrun, R., & Graesser, A. (2014). Confusion can be beneficial for learning. *Learn. Instr.* 29, 153–170. doi: 10.1016/j.learninstruc.2012.05.003
- Dennen, V., Darabi, A., Smith, L. (2007). Instructor-Learner Interaction in Online Courses: The relative perceived importance of particular instructor actions on performance and satisfaction. *Distance Education*. 28. 65-79. 10.1080/01587910701305319.
- Dewaele, J.-M. (2004). The Emotional Force of Swearwords and Taboo Words in the Speech of Multilinguals. *Journal of Multilingual and Multicultural Development* 25 (2/3), pp. 204-222. ISSN 0143-4632.
- Dewaele, J.-M., Petrides, K. V., & Furnham, A. (2008). Effects of trait emotional intelligence and sociobiographical variables on communicative anxiety and foreign language anxiety among adult multilinguals: A review and empirical investigation. *Language Learning*, 58, 911–960. doi:[10.1111/j.1467-9922.2008.00482.x](https://doi.org/10.1111/j.1467-9922.2008.00482.x).[CrossRefGoogle Scholar](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=JmDewaele&citation_for_view=JmDewaele%2F10.1111%2Fj.1467-9922.2008.00482.x)
- Dewaele, J.-M., Witney, J., Saito, K., & Dewaele, L. (2018). Foreign language enjoyment and anxiety: The effect of teacher and learner variables. *Language Teaching Research*, 22(6), 676–697. <https://doi.org/10.1177/1362168817692161>
- Dewaele, J.-M., & MacIntyre, P. D. (2014). The two faces of Janus? Anxiety and enjoyment in the foreign language classroom. *Studies in Second Language Learning and Teaching*, 4(2), 237-274. <https://doi.org/10.14746/ssllt.2014.4.2.5>
- Do, H.-D., Wen, J.-M., & Huang, S.-K. (2021). Impact of Humorous Chinese-Teaching Videos and Echo Method on Teaching Chinese Language: A Case Study of Vietnamese

- Students. *Asia-Pacific Edu Res* (2021). <https://doi.org/10.1007/s40299-021-00622-5>
- Dolcos, F., LaBar, K. S., & Cabeza, R. (2004). Interaction between the Amygdala and the Medial Temporal Lobe Memory System Predicts Better Memory for Emotional Events, *Neuron*, Volume 42, Issue 5, 2004, <https://doi.org/10.1080/09500790802485237>
- Dörnyei, Z. (2009). *The psychology of second language acquisition*. Oxford: Oxford University Press. 356 pp.. *Boletín de Linguística*. 22. 131-139.
- Ryan, S., & Dörnyei, Z. (2015). *The Psychology of the Language Learner Revisited*. 10.4324/9781315779553.
- Drevets, W. C., & Raichle, M. E. (1998). Reciprocal suppression of regional cerebral blood flow during emotional versus higher cognitive processes: Implications for interactions between emotion and cognition. *Cognition and Emotion*, 12(3), 353–385. <https://doi.org/10.1080/026999398379646>
- Dulay, H., & Burt, M. (1977). Remarks on Creativity in Language Acquisition. In M. Burt, H. Dulay, & M. Finocchiaro (Eds.), *Viewpoints on English as a Second Language* (pp. 95-126). New York: Regents.
- Ferre, P., Sanches-Casas, R., & Fraga, I. (2013). Memory for emotional words in the first and the second language: Effects of the encoding task. *Bilingualism: Language and Cognition*, 16(3), 495-507. doi:10.1017/S1366728912000314
- Frijda, N.H. Not Passion's Slave. *Emotion Review*. 2010;2(1):68-75. doi:10.1177/1754073909345543
- Gardner, R. C. (1985). *Social Psychology and Second Language Learning: The Role of Attitude and Motivation*. Baltimore, MD: Edward Arnold.
- Gokool-Ramdoo, Sushita. (2009). Policy Deficit in Distance Education: A Transactional Distance. *International Review of Research in Open and Distance Learning*. 10. 10.19173/irrodl.v10i4.702.
- Gopal, R., Singh, V. & Aggarwal, A. (2021) Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19. *Educ Inf Technol* 26, 6923–6947. <https://doi.org/10.1007/s10639-021-10523-1>
- Gray, J. (2001). Emotional Modulation of Cognitive Control: Approach-Withdrawal States Double Dissociate Spatial From Verbal 2-back Task Performance. *Journal of experimental psychology. General*. 130. 436-52. 10.1037/0096-3445.130.3.436.

- Gyurak, A., Goodkind, M. S., Kramer, J. H., Miller, B. L., & Levenson, R. W. (2012). Executive functions and the down-regulation and up-regulation of emotion. *Cognition and Emotion*, 26(1), 103–118. <https://doi.org/10.1080/02699931.2011.557291>
- Habel, U., Koch, K., Pauly, K., Kellermann, T., Reske, M., Backes, V., Seiferth, N. Y., Stöcker, T., Kircher, T., Amunts, K., Shah, N. J., & Schneider, F. (2007). The influence of olfactory-induced negative emotion on verbal working memory: Individual differences in neurobehavioral findings, *Brain Research*, Volume 1152, Pages 158-170.
- Harbon, L. (2008). Chinese Students in a ‘Sea’ of Change: One Teacher's Discoveries about Chinese Students’ Learning and Emotions Through Use of Song. *Evaluation & Research in Education* 21(3):214-234 DOI: 10.1080/09500790802485237 In: Carlos Perrián. (Org.). *Revisiting Language Learning Resources*. Newcastle: xxx
- Heuer, F., & Reisberg, D. (1990). Vivid memories of emotional events: The accuracy of remembered minutiae. *Memory & Cognition*, 18, 496-506.
- Hew, K. F., & Cheung, W. S. (2014). Students’ and Instructors’ Use of Massive Open Online Courses (MOOCs): Motivations and Challenges. *Educational Research Review*, 12, 45-58. <http://dx.doi.org/10.1016/j.edurev.2014.05.00>
- Hinojosa, J. A., Moreno, E. M., & Ferré, P. (2020). On the limits of affective neurolinguistics: a “universe” that quickly expands, *Language, Cognition and Neuroscience*, DOI: 10.1080/23273798.2020.1761988
- Hutchison, I. C., Pezzoli, S., Tsimpanouli, M. E., Abdellahi, M., Pobric, G., Hulleman, J., & Lewis, P. A. (2021). Targeted memory reactivation in REM but not SWS selectively reduces arousal responses. *Communications biology*, 4(1), 404. <https://doi.org/10.1038/s42003-021-01854-3>
- Ivaz, L., Costa, A., & Duñabeitia, J. A. (2016). The emotional impact of being myself: Emotions and foreign-language processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 42(3), 489–496. <https://doi.org/10.1037/xlm0000179>
- Jin, Y., Dewaele, J.-M., & MacIntyre, P.D. (2021). Reducing anxiety in the foreign language classroom: A positive psychology approach, *System*, Volume 101, 2021,102604, ISSN 0346-251X, <https://doi.org/10.1016/j.system.2021.102604>. (<https://www.sciencedirect.com/science/article/pii/S0346251X21001585>)

- Joëls M, Pu Z, Wiegert O, Oitzl MS, Krugers HJ. Learning under stress: how does it work? Trends Cogn Sci. 2006 Apr;10(4):152-8. doi: 10.1016/j.tics.2006.02.002. Epub 2006 Mar 2. PMID: 16513410.
- Kaakinen, M., Räsänen, P., Näsi, M. et al. Social capital and online hate production: A four country survey. Crime Law Soc Change 69, 25–39 (2018). <https://doi.org/10.1007/s10611-017-9764-5>
- Kensinger, E. A. (2009). Remembering the Details: Effects of Emotion. Emotion review : journal of the International Society for Research on Emotion, 1(2), 99–113. <https://doi.org/10.1177/1754073908100432>
- Kensinger, E. A., & Corkin, S. (2003). Effect of Negative Emotional Content on Working Memory and Long-Term Memory. Emotion, 3(4), 378–393. <https://doi.org/10.1037/1528-3542.3.4.378>
- Kensinger, E. A, & Ford, J. H. (2020). Retrieval of Emotional Events from Memory. Annu Rev Psychol. 2020 Jan 4;71:251-272. doi: 10.1146/annurev-psych-010419-051123. Epub 2019 Jul 5. PMID: 31283426.
- Khajavy, G., MacIntyre, P., & Barabadi, E. (2018). Role of the emotions and classroom environment in willingness to communicate: applying doubly latent multilevel analysis in second language acquisition research. Studies in Second Language Acquisition, 40(3), 605-624. doi:10.1017/S0272263117000304
- Kleinmann, H. (2006). Avoidance Behavior in Adult Second Language Acquisition. Language Learning. 27. 93 - 107. 10.1111/j.1467-1770.1977.tb00294.x.
- de Kloet, E., Oitzl, M. & Joels, M. (1999). Stress and cognition: are corticosteroids good or bad guys? TINS 22: 422-426. Trends in neurosciences. 22. 422-6. 10.1016/S0166-2236(99)01438-1.
- Kosek, M., & Lison, P. (2014). An intelligent tutoring system for learning Chinese with a cognitive model of the learner. In S. Jager, L. Bradley, E. J. Meima, & S. Thouësnny (Eds), CALL Design: Principles and Practice; Proceedings of the 2014 EUROCALL Conference, Groningen, The Netherlands (pp. 179-184). Dublin: Research-publishing.net. doi:10.14705/rpnet.2014.000214
- Krashen, S. D. (1982). Principles and practice in second language acquisition. Oxford: Pergamon Press.
- Levine, L., & Burgess, S. L. (2011) Beyond General Arousal: Effects of Specific Emotions on Memory

- Lieury, A., Boissiere, I., Jamet, E. and Marinkovic, K. (1997) Les mots grossiers et sexuels sont-ils mieux mémorisés que des mots neutres? *Le Langage et l'Homme* 32 (1), 17/37.
- Lindström, B.R., Bohlin, G.(2011) Emotion processing facilitates working memory performance. *Cogn Emot.* 2011 Nov;25(7):1196-204. doi: 10.1080/02699931.2010.527703. Epub 2011 Jul 6. PMID: 21728906.
- Liston, C., McEwen, B.S., Casey, B.J. (2009) Psychosocial stress reversibly disrupts prefrontal processing and attentional control. *Proc Natl Acad Sci U S A.* 2009 Jan 20;106(3):912-7. doi: 10.1073/pnas.0807041106. Epub 2009 Jan 12. PMID: 19139412; PMCID: PMC2621252.
- McGaugh, J. L., Cahill, L., & Roozendaal, B. (1996). Involvement of the amygdala in memory storage: interaction with other brain systems. *Proc Natl Acad Sci USA* 93: 13508-13514. *Proceedings of the National Academy of Sciences of the United States of America.* 93. 13508-14. 10.1073/pnas.93.24.13508.
- MacIntyre P., & Gregersen T. (2012). *Affect: The Role of Language Anxiety and Other Emotions in Language Learning.* In: Mercer S., Ryan S., Williams M. (eds) *Psychology for Language Learning.* Palgrave Macmillan, London. [https://doi.org/10.1057/9781137032829\\_8](https://doi.org/10.1057/9781137032829_8)
- MacIntyre, P. (2002). 3. Motivation, anxiety and emotion in second language acquisition. 10.1075/lllt.2.05mac. In P. Robinson (Ed.), *Individual differences and instructed language learning* (pp. 45-68). Philadelphia: John Benjamins.
- MacIntyre, P. D., & Vincze, L. (2017). Positive and negative emotions underlie motivation for L2 learning. *Studies in Second Language Learning and Teaching*, 7(1), 61-88. <https://doi.org/10.14746/ssllt.2017.7.1.4>
- Mackay, D. G., Shafto, M., Taylor, J. K. et al. (2004). Relations between emotion, memory, and attention: Evidence from taboo Stroop, lexical decision, and immediate memory tasks. *Memory & Cognition* 32, 474–488. <https://doi.org/10.3758/BF03195840>
- Miller, Z., & Godfroid, A. (2020). Emotions in incidental language learning^ an individual differences approach. *Studies in Second Language Acquisition*, 42(1), 115-141. doi:10.1017/S027226311900041X
- Montag, C., & Panksepp, J. (2017). Primary emotional systems and personality: an evolutionary perspective. *Front. Psychol.* 8:464. doi: 10.3389/fpsyg.2017.00464

- Moore, M. (1989). Three Types of Interaction. *American Journal of Distance Education*, 3, 1-7. [10.1080/08923648909526659](https://doi.org/10.1080/08923648909526659).
- Moore, M. G. (1993). Theory of Transactional Distance. In D. Keegan (Ed.), *Theoretical Principles of Distance Education* (pp. 22-29). New York: Routledge.
- Neisser, U., & Harsch, N. (1992). Phantom flashbulbs: False recollections of hearing the news about Challenger. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall: Studies of "flashbulb" memories* (pp. 9-31). Cambridge University Press. <https://doi.org/10.1017/CB09780511664069.003>
- Neufeld, J. E., Rasmussen, H. N., Lopez, S. J., Ryder, J. A., Magyar-Moe, J. L., Ford, A. I., Edwards, L. M., & Bouwkamp, J. C. (2006). The Engagement Model of Person-Environment Interaction. *The Counseling Psychologist*, 34(2), 245-259. <https://doi.org/10.1177/0011000005281319>
- Osaka, N., Minamoto, T., Yaoi, K., & Osaka, M. (2011). Effect of negative and positive emotion on working memory performance: an fMRI study. *Clinical Neurophysiology*, Volume 122, Supplement 1, 2011, Pages S11-S12, ISSN 1388-2457, [https://doi.org/10.1016/S1388-2457\(11\)60036-9](https://doi.org/10.1016/S1388-2457(11)60036-9). (<https://www.sciencedirect.com/science/article/pii/S1388245711600369>)
- Pikhart, M. (2021). Human-computer interaction in foreign language learning applications: Applied linguistics viewpoint of mobile learning, *Procedia Computer Science*, Volume 184, Pages 92-98, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2021.03.123>. (<https://www.sciencedirect.com/science/article/pii/S1877050921007729>)
- Pillemer, D. B., Rhinehart, E. D., & White, S. H. (1986). Memories of life transitions: The first year in college. *Human Learning: Journal of Practical Research & Applications*, 5(2), 109-123.
- de Quervain, D.J., Roozendaal, B., Nitsch, R.M., McGaugh, J.L., Hock, C. (2000) Acute cortisone administration impairs retrieval of long-term declarative memory in humans. *Nat Neurosci*. Apr;3(4):313-4. doi: 10.1038/73873. PMID: 10725918.
- Rapaport, D. (1943). Emotions and memory. *Psychological Review*, 50(2), 234-243. <https://doi.org/10.1037/h0055721>
- Rothermund, K., Koole, S.L (2018). Three decades of Cognition & Emotion: A brief review of past highlights and future prospects. *Cognition and Emotion*, 32, 1-12 <https://doi.org/10.1080/02699931.2018.1418197>

- Rubin, D. C., & Kozin, M. (1984). Vivid memories. *Cognition*, 16(1), 81–95. [https://doi.org/10.1016/0010-0277\(84\)90037-4](https://doi.org/10.1016/0010-0277(84)90037-4)
- Schumann, J. H. (1978). *The pidginization process: A model for second language acquisition*. Rowley Mass: Newbury House.
- Scovel, T. (2006). The Effect of Affect on Foreign Language Learning: A Review of the Anxiety Research. *Language Learning*, 28, 129 - 142. 10.1111/j.1467-1770.1978.tb00309.x.
- Steele, B. J. (2017). Recognising, and Realising, the Promise of the Aesthetic Turn. *Millennium: Journal of International Studies* 45 (2): 206–13.10.1177
- Steele, B. J. (2021). When Good Enough Is Good Enough: Department Chairing during COVID-19. *PS: Political Science & Politics* 54 (1): 187–88.
- Storbeck J, Maswood R. (2016) Happiness increases verbal and spatial working memory capacity where sadness does not: Emotion, working memory and executive control. *Cogn Emot*. 2 Aug;30(5):925-38. doi: 10.1080/02699931.2015.1034091. Epub 2015 May 7. PMID: 25947579.
- Swain, M. (2013). The inseparability of cognition and emotion in second language learning. *Language Teaching*, 46, 1 - 13. 10.1017/S0261444811000486.
- Talmi, D., & Moscovitch, M. (2004). Can semantic relatedness explain the enhancement of memory for emotional words? *Memory & Cognition*, 32(5), 742–751. <https://doi.org/10.3758/BF03195864>
- Tian, F., Gao, P., Li, L., Zhang, W., Liang, H., Qian, Y., & Zhao, R. (2014). Recognizing and regulating e-learners' emotions based on interactive Chinese texts in e-learning systems, *Knowledge-Based Systems*, Volume 55, 2014, Pages 148-164, ISSN 0950-7051.
- Tollenaar, M.S., Elzinga, B.M., Spinhoven, P, Everaerd, W. (2008) Immediate and prolonged effects of cortisol, but not propranolol, on memory retrieval in healthy young men. *Neurobiol Learn Mem*. 2009 Jan;91(1):23-31. doi: 10.1016/j.nlm.2008.08.002. Epub 2008 Sep 14. PMID: 18761097.
- Tong, P., & Tsung, L. (2020). Humour strategies in teaching Chinese as second language classrooms, *System*, Volume 91, 2020, 102245, ISSN 0346-251X, <https://doi.org/10.1016/j.system.2020.102245>.  
(<https://www.sciencedirect.com/science/article/pii/S0346251X19307304>)
- Tyng, Ch. M., Amin, H. U., Saad, M. N. M., & Malik, A. S. (2017). The Influences of Emotion on Learning and Memory. *Frontiers in Psychology*, 8



- Wang, Y., Cao, Y., Gong, Sh., Wang, Zh., Li, N., & Ai, L. (2022). Interaction and learning engagement in online learning: The mediating roles of online learning self-efficacy and academic emotions, *Learning and Individual Differences*, Volume 94, 2022, 102128, ISSN 1041-6080, <https://doi.org/10.1016/j.lindif.2022.102128>.(https://www.sciencedirect.com/science/article/pii/S1041608022000152)
- Wang, Z. (2021). Addressing migrants' well-being during COVID-19: An analysis of Chinese communities' heritage language schools in Germany, *Migration Studies*, Volume 9, Issue 3, September 2021, Pages 1144–1165, <https://doi.org/10.1093/migration/mnaa033>
- Winter, D., Elzinga, B., & Schmahl, C. (2014). Emotions and Memory in Borderline Personality Disorder. *Psychopathology* 2014;47:71-85.
- Wolf, O.T (2009) Stress and memory in humans: Twelve years of progress?, *Brain Research* (2009), doi:10.1016/j.brainres.2009.04.01
- Xie, M. (2021). Increase in income and international promotion of language: Evidence from China, *International Review of Economics & Finance*, Volume 73, Pages 275-289, ISSN 1059-0560, <https://doi.org/10.1016/j.iref.2021.01.004>.
- Xiujian, T., Peishan, C., & Haiqin, Y. (2022). Potential Conditions for Linking Teachers' Online Informal Learning with Innovative Teaching, Thinking Skills and Creativity, 2022, 101022, ISSN 1871-1871, <https://doi.org/10.1016/j.tsc.2022.101022>. (https://www.sciencedirect.com/science/article/pii/S1871187122000256)
- Xuebing, L. (2021). Emotional Working Memory Training Promotes Explicit Emotion Regulation and Implicit Negative Control, *International Journal of Psychophysiology*, 168, S64-S64.
- Yeh, Y., Lai, G-J., Lin, C., Lin, Ch., & Sun, H. (2014). How stress influences creativity in game-based situations: Analysis of stress hormones, negative emotions, and working memory, *Computers & Education*, Volume 812015, Pages 143-153, ISSN 0360-1315, <https://doi.org/10.1016/j.compedu.2014.09.011>. (https://www.sciencedirect.com/science/article/pii/S0360131514002115)
- Zhang, L., & Tsung, L. (2021). Learning Chinese as a second language in China: Positive emotions and enjoyment, *System*, Volume 96, 2021, 102410, ISSN 0346-251X.



# Appendix

## A. Example of an instruction, given to the participants of the experimental group.

Here, you can see 20 Chinese words. Your aim is to memorize them in a week. You are allowed to participate in the experiment only in case that all the words in the list are new for you.

Read the words in the left column.

Come up with a story or draw a small picture in which each word from column 1 will be associated with those emotions marked by + in columns 2, 3, 4 or 5. Try not to use words and verbal thinking in your native language while creating the association between a Chinese word and an emotion – use gestures, body expression or images.

Example: "Porridge-Anger". Disgrace, we were again served this vile porridge for breakfast! It is impossible to eat.

Try to memorize each new word based on the emotion associated with it. In a week I will send a test with which you can assess the strength of memorization of the four components of each word: hieroglyph, pinyin, tones and meaning.

Emotion Word	Anger	Fear	Joy	Interest
1. 粥 zhou1 porridge	+			
2. 雷 lei2 thunder	+			
3. 土 tu3 earth	+			
4. 石 shi2 stone	+			

5.	星 xing1 star	+			
6.	坏 huai4 bad		+		
7.	姜 jiang1 ginger		+		
8.	弱 ruo4 weak		+		
9.	瘦 shou4 thin		+		
10.	胖 pang4 fat		+		
11.	鱼 yu2 fish			+	
12.	田 tian2 field			+	
13.	狗 gou3 dog			+	
14.	菜 cai4 vegetable			+	
15.	汤 tang1 soup			+	
16.	火 huo3 fire				+
17.	毛 mao2 hair				+

18. 面 mian4 noodles, surface, wheat				+
19. 米 mi3 rice				+
20. 虎 hu3 tiger				+

**B. Samples of creativity in which a word is associated with an emotion.**

*Tiger-Anger*

I imagine a poacher who killed a tiger and I want to imprison him for 15 years.

*Tiger-Joy*

I am a truck driver in the Far East of Russia, and I am glad that I saw a tiger sitting in the cab of my truck, and not next to me in the forest.

*Rice-Fear*

Famine is coming, there will be no rice.

*Porridge-Interest*

What happens if you cook porridge not on water, but on beef broth?