Poznań Studies in Contemporary Linguistics 46(3), 2010, pp. 275–293

doi:10.2478/v10010-010-0016-4

MENTAL POLLUTION HYPOTHESIS AND FOREIGN VOCABULARY RETENTION

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ABSTRACT

Research into second language acquisition lists several factors – social, psychological, cognitive, and affective – as reasons for the failure or low performance of many adult language learners. This present study was conducted to show that in addition to these factors it can also be greatly slowed by mental pollution – any 'contamination of the mind' by various forms of affective visual distractors, ranging in scope from violent or sexually suggestive images to comedic commercial advertisements and coming from a variety of media sources – from which younger learners are mostly protected but older learners are accustomed to encountering on an almost daily basis. In order to test the mental pollution hypothesis, 106 university students participated in the experiment which comprised vocabulary teaching along with two different treatments: mental pollutants being the first and free class time with relaxing music in the background comprising the second. The Equivalent Materials, Pretest, Posttest Design together, including descriptive statistics and paired sample t-tests, were used to analyze the vocabulary scores derived from the two treatments. The findings of the experiment indicate that when learners are exposed to high level of mental pollution, they demonstrate low retention of new vocabulary in a foreign language.

KEYWORDS: Mental pollution; memory; vocabulary learning.

1. Introduction

Perhaps the most well-known theory of why adult learners generally have more trouble than children when acquiring a second language is the 'critical period' hypothesis. While the critical period hypothesis does provide some explanation of one reason why adults find it difficult to learn a second language, a large body of research also indicates that age is not always a drawback but at times can be an advantage when learning a sec-

ond or a foreign language (Snow and Hoefnagel-Hohle 1978; Eckstrand 1978). According to these findings motivational factors might better explain the differences between children and adults in learning other languages. Bialystok (1997) and Hyltenstam and Abrahamsson (2003) report that the amount of research which links proficiency in second language mainly to maturational factors is limited. Bialystok (1997) asserts that length of residence in tandem with the amount of time spent speaking the second language play a greater role in second language acquisition than the age factor. Also, Perani and Abutalebi (2005) argue that lexical-semantic processing in L2 depends more on proficiency in the target language rather than the age of acquisition. They believe that alternative factors like usage and exposure to a target language may have a certain impact on brain plasticity mechanisms and neural substrate which seem to affect L2 processing. The "Joseph Conrad Phenomenon", named for a Polish author of English novels who was a fluent and gifted writer of the English language, is a striking example that confirms that adults are able to attain native-like L2-proficiency (Bongaerts et al. 1995). Likewise, Scovel's (1988) comprehensive research did not confirm age as a negative factor in acquiring a foreign language. The same researcher argues that except for the acquisition of pronunciation, there is no absolute proof that biological limitations exist in language acquisition.

1.1. Age factor and cognition

Neurolinguistic research findings, for example Greenough (1997: 19), support the idea that adults, like children, are capable of acquiring a native-like proficiency in a foreign language:

> Currently, we have no reason to think that there are critical periods for the acquisition of culturally and socially transmitted skills, like reading, mathematics, or music, just to name a few of the favorite examples. As far as we know, people can acquire these skills at any age; can benefit from instruction at any age; and can increase their intelligence and expertise, given the right opportunities, at any age.

Further studies in neuroscience have indicated that the adult brain is able to maintain extensive neural restructuring and synaptic interconnections throughout human life (Chechik et al. 1997). Nelson and Bloom (1997) and similarly Ostwald and Williams (1981) also argue that people have the power to learn as long as they live and this is unquestionable, for the human brain is capable of reorganizing its structure according to every new experience it encounters. These diverse findings indicate that age is not an insurmountable obstacle for language learners after puberty, as some defending the notion of a strong critical period have asserted.

Given that age is not the sole determining factor of proficiency in foreign language learning, the inhibitive role of other factors responsible for most adults' limited lan-

guage performance needs to be reconsidered. Cook (2001: 113) mentions the following factors in the failure of many adult learners when learning a foreign language:

> physical factors such as the loss of "plasticity" in the brain and "lateralization" of the brain; social factors such as the different situations and relationships that children encounter compared to adults; and cognitive explanations such as interference with natural language learning by the adult's more abstract mode of thinking.

Scovel (1988) and Krashen (1985), similarly, argue that rather than stemming from age, differences in the mastery of a second language after puberty may stem from inconsistent social, psychological, and affective factors like attitude, motivation, self-esteem, and comprehensible input – understandable messages in the target language. A substantial number of studies cite the presence of the following factors – auditory inability (Pimsleur 1968), learning difficulties (Dinklage 1971), aptitude for language learning and linguistic coding differences (Sparks and Ganschow 1995), methodological weakness (Au 1988), learning styles, personality dispositions, motivation, learning strategies, self-efficacy, and anxiety (Ehrman 1996), physiological problems (Joiner 1981), psycholinguistic considerations, (Doughty and Long 2003) – that make it difficult for adults to learn foreign languages.

Having briefly mentioned the practical irrelevance of the age factor and the support of neurolinguistics for the potential mastery of a second language after the critical period, a period before puberty when the human mind is thought to be most ready to acquire a language (Lenneberg 1967), we will address the second of Cook's (2001) failure factors – the situational difference between adult and children language learners – by examining how the mental pollution hypothesis may explain the main obstacle for adults seeking to achieve noteworthy competence in a second language, something considered to be quite easy for children. We will argue instead that mental pollution – a person's frequent exposure to cognitively distracting and emotionally affective external stimuli in different forms – plays a far greater role in either the success or failure in learning, including foreign languages, than maturational factors – most particularly the plasticity of the brain or brain lateralization related to age – although their influence certainly cannot be altogether overlooked. In order to clarify what is meant by mental pollution, brief information will be given about the relation of memory to language learning and mental pollution.

1.2. The memory factor in foreign language learning

From neurological research we know the human brain has more than one hundred billion neurons by whose synaptic density and countless connections the human mind is able to both learn and retrieve vast amounts of information. The stronger the neural connection, the stronger is one's memory. Physiological factors – insufficient oxygen,

glucose, or enzymes in the brain – as well as psychological factors such as stress and sleep quality have been enumerated among the causes of forgetting, whose rate differs from person to person (Ashcraft and Kirk 2001). It has been also reported that poor memory, like calling your present colleague by the name of previous colleague or getting off the wrong train station because you used to live near it, is caused by displacement and interference from other information or activities over time (Cardwell and Flanagan 2005). Furthermore, several studies on short-term memory (Lightbown and Spada 1999; Baddeley 2001; Cowan 2001; Conway et al. 2005) have also revealed the strong relationship between memory and language ability (Marian and Neisser 2000). For example, Cook (2001) describes at length the involvement of different memory types – long term memory, short-term memory, working memory, the articulatory loop – in second language use by highlighting the fact that the human mind is notably less efficient in a second language with any task with what he calls "cognitive deficit".

Additionally, Joseph Ledoux notes that different kinds of emotions can affect memory:

> For example, a mild compliment may only be registered and stored in explicit memory, but glowing praise, registered explicitly, might lead to the arousal of emotion systems that then also store aspects of the experience implicitly. On the other hand, stress is known to impair explicit memory while at the same time enhancing the implicit memory functions of emotion systems.
>
> (LeDoux 2002: 29)

LeDoux distinguishes between two types of memory: explicit and implicit. It is important to note that explicit memory is the kind of memory which is most usually utilized when one is bending one's will and attention to formal learning, such as when one attempts to first memorize new lexical units in a foreign language, whereas implicit memory functions with regards to regulating our senses, emotions, reflexes, automatic body functions, instincts and so on:

> The systems that engage in implicit learning are not strictly speaking memory systems. They were designed to perform specific functions, like perceiving stimuli, controlling precise movements, maintaining balance, regulating circadian rhythm, detecting friend and foe, finding food, and so on; plasticity (the ability to change as a result of experience) is simply a feature of the neuronal infrastructure of these systems that facilitates their operation.
>
> (LeDoux 2002: 117)

This all suggests that the certain kinds of emotionally-charged or highly affective distractions can cause stress, which may in turn impair one's ability to store new information in one's explicit memory, as the implicit systems may be interfering with the explicit memory's retention process. Likewise, as LeDoux notes above, creating an emotionally positive atmosphere may actually activate the implicit memory systems in such a way that they reinforce input stored in the explicit memory, thus suggesting that the

absence of stressful distractors and the presence of an emotionally soothing environment will result in higher memory retention.

1.3. Mental pollution

According to Fairbrother et al. (2004: 122), "[m]ental pollution can be induced by a thought, a visual image, a critical remark, insult or accusation, or by a memory. It can also be revived by memories". In the current study, we will focus specifically on comedic, violent and sexually suggestive distractors in various media formats ranging from short internet clips to popular commercial advertisements which may be said to constitute the most common form of intentional or unintentional exposure to mental pollution adults experience today. Exposure to pollution is practically unavoidable for most people living in developed or industrialized areas, in part due to the pervasive overabundance of such media in our everyday lives. As an example, a student searching for certain pictures or videos about *love* on the internet for a PowerPoint class presentation may end up with exposure to innumerable irrelevant images and obsolete information, ranging from mundane text advertisements to sexually explicit images or to high-quality videos featuring bizarre or outrageous content, which may not only distract their attention and perhaps even clutter their working memory, but may also result in physiological distractions such as exciting their emotions or arousing their libido. Depending on their quality and purpose, once encountered in large enough volume such pollutants can frequently excite strong emotional responses, ranging from comic enjoyment to anger and frustration, or even induce some level of sexual arousal, which instantly increases the blood pressure and heart rate, thereby diminishing their ability to focus fully on difficult cognitive tasks such as acquiring a second language. In the latter instance, it should be noted that it is primarily adults who are permitted to view certain kinds of material, such as sexually suggestive entertainment or crude forms of comedy, because of the independence provided by their age. Children, to the contrary, are usually prohibited from such exposure both by common cultural mores and their relative incapacity for intentional self-exposure. Indeed, according to a 2002 report commissioned by the National Research Council:

> As a general rule, young children do not have the cognitive skills needed to navigate the Internet independently. Knowledge of search strategies is limited if not nonexistent, and typing skills are undeveloped. These factors tend to limit young children's potential exposure to sexually explicit material on the Internet until about age 10, the transition from childhood to the preadolescent years.
>
> (Lin and Thornburgh 2002: 115)

Adults, of course, are a different story altogether, and are therefore more readily targeted and exposed to mental pollution by the content of TV programs, movies, internet sites, video games, magazines, newspapers, billboards, and shop windows. Due to the

constant cognitive pressure and emotional responses that accompany such affective stimulation, it is may not be easy for many adults to maintain a strong and stable memory or attention span in environments filled with such distractions, and correspondingly they may in some cases suffer from emotional instability and serious concentration and reasoning problems both in their professional and private daily lives. For example, Bushman's (2005) study revealed that watching violent television programs has detrimental effects on one's memory and ability to remember things. Similarly, Kiefer et al. (2007) carried out an experiment in neurophysiology which clearly indicated the deep impact of stable and unstable emotional mood states on human memory and cognition. They discovered that coherent memory and subsequent successful recall is attainable merely by keeping healthy long-lasting emotional mood states. Therefore, emotional states apparently play a significant role in various memory functions, for they can either facilitate or obstruct the acquisition and retrieval of information (Rosenfield 1988).

Contrary to the commonly held belief that we use only ten percent of our mind, as well as the assertion that we can therefore store seemingly infinite neural interactions, the human memory indeed has certain limitations (Kahneman 1973). For example, it tends to store extraordinary experiences more than it does ordinary ones. Despite this, mental pollutants can interfere with our focus, distract our attention and occupy a huge amount of our short-term memory space, thus limiting our cognitive ability to acquire and store important information. Even though the brain has a huge capacity to store data, the effects of the massive amount of incoming data, much of which is largely trivial, cannot be overestimated, especially given reports on how much people – and adults in particular – watch TV, play computer games, and surf on the internet regularly. According to research by the Entertainment Software Association (2004), the average age of video game players is 33, and they spend approximately 7.5 hours per week in front of the monitor. Such video games, whose popularity has been increasing rapidly with their increased speed, detailed graphics, and online facilities (Williams 2002), can inhibit the language learning process when combined with the lack of time or desire to study or concentrate.

Csikszentmihalyi (1990) and Lee and LaRose (2007) use the term *flow* to describe the enjoyable sensations one receives from activities one is whole-heartedly engaged in. This is a kind of psychological condition in which a person is so occupied in and intrinsically rewarded by an activity that nothing else seems to matter. A person in flow can be said to be "lost" in an activity; they perform it unthinkingly, without having to constantly devote any conscious consideration to their actions. For example, one can said to be in flow when he or she is deeply immersed in a novel. Likewise, flow can include tasks as sophisticated as when a mathematician is completely focused on working through a familiar mathematical equation, or as trivial as when one is completely lost in even the most mundane chore, such as mopping the floor.

Flow can provide us with a some extreme examples of how mental pollution can come to inhibit one's cognitive aptitude. The concept of flow, while usually denoting healthy engagement in a familiar vocation, can also be applied to other habits that can

facilitate pollution of the mind. For example, getting lost in a computer game may be enjoyable, but it is also both cognitively demanding and emotionally and physiologically affecting. Likewise, aimlessly surfing the internet can be considered a kind of flow, but can lead one through a kind of endless maze wherein one is constantly barraged by unorganized, fragmented and unnecessary information – including, but not by any means limited to, emotionally affective, violent, and sexually explicit images – that the process not only inhibits long-term memory formation, but it can also lead to a state of cognitive disarray which saps one's ability to concentrate for long periods of time, thus doubly impairing the core cognitive powers regularly utilized in the language learning process and causing one form of mental pollution.

While such activities in large doses can be a handicap to some cognitive functions, they nevertheless hold mass appeal for many who desire the kinds of affective experiences they offer and that some people may not otherwise be able to acquire. For instance, based on a study of the personality of television viewers, Eysenck (1978) reported that sensation-seeking was the main cause behind excessive television watching, and it was mainly people who were regularly emotionally un-aroused who watched TV, presumably for increased satisfaction because of its violent and sexual content.

While this is not inherently negative, this kind of behavior can conceivably develop into habitual self-neglect, which can come to seem like a kind of addiction because of the neurologically rewarding stimulation they supply. Such addictive behavior can conceivably become disastrous in the extreme. In fact, experiments on rats have shown that the animals simply choose to starve to death due to hunger and dehydration when they are hooked to reward-stimulus circuits in ever-expanding quests for neuro-orgasms (Robinson 2009). That is, a mechanism is provided to allow the animal to activate a pleasing stimulus to the brain; otherwise, the animal is also allowed to go search for food in the experimental environment, yet simply chooses not to search. In this way, mental pollution can be understood as interfering in memory formation, neuro-chemical balance, and attention span, thus detrimentally affecting many of the key cognitive components that facilitate language learning.

The purpose of the present study is to fill a gap in the language learning literature by confirming the following hypothesis: that the presence, amount, and intensity of mental pollution in the learning environment drastically hinders foreign language learning, and vice versa, and that the absence of mental pollution in the learning environment facilitates language learning.

2. Method

2.1. Participants and setting

A total of 106 Georgian freshman students, 43 males and 63 females, whose age range was between 18 and 20 enrolled in three different classes in the American Studies Pro-

gram at International Black Sea University (IBSU) in Georgia, one of the top universities whose language medium is English, took part in the study. Their reports indicated that the students were all highly successful in the National University Entrance Exam (NUEE) that consists of one hundred questions in three parts: logic, science and language (English). The three classes were formed based on the scores the students received from NUEE so that unequal distribution among classes was avoided. Almost all participants were multi-lingual and spoke Georgian, Russian and English. The oral interview with the students and their high-school records revealed that almost all subjects had a similar background of language learning; apart from Georgian, Russian and English, they neither knew German nor had received any German tuition in the past. Thus, a pre-test to determine their level of German was excluded in the study. When they were told about the experiment, they were all motivated and willing to take the challenge and contribute to the research.[1]

2.2. Instrumentation and data collection procedures

For the experiment, data was collected from the 106 students in three classes who received the same two different treatments after a month interval. The same group of students served as both experimental and control groups. Although the experiment was described in detail beforehand to the groups, a time period of 4 weeks was particularly chosen so that the students would forget about the previous treatment over time, which otherwise might have influenced the results of the experiment. For both treatments the same teacher of German with 12 years of teaching experience from the same university was assigned to make the experiment as objective as possible. He unilaterally chose two sets of fifteen random, unknown German words, each set consisting of 5 nouns, 5 verbs, and 5 adjectives, from a basic German–English Dictionary. The selected thirty target German words were meticulously studied by several foreign language teachers of Georgian, Russian, English, and German with the purpose of avoiding any guessing factor dependent on the word forms, such as word length, syllables, pronunciation, spelling, and cognates; for certain word clues might interfere and reduce the validity of the study. Each word in both treatments was worth one point, making a total of 15 points.

2.3. Materials and instruction

At the beginning, the students were told that this experiment was about seeing how well we remember foreign language vocabulary under certain conditions, including a de-

[1] The authors recognize that there are some intrinsic shortcomings with the empirical part of the study. As this was a relatively novel topic which had not yet been researched, and since the theoretical underpinnings of the topic were quite complex and little investigated before now, the experiment itself suffered in its scope and method. The data set was limited and the experiment only investigates the impact on vocabulary memorization. For that purpose, the thesis will require further investigation in order to be fully verified.

tailed description of treatment. They were informed that in the procedure they would learn a set of fifteen German words and be tested on them later after watching short videos. In order to provide conformity in both treatments, all subjects received the same type of vocabulary teaching technique, including both its "translation" and a picture of the word, because of its necessity as well as practicality in evaluation and application. Broadly speaking, the teacher was obliged to translate and provide visual aids while presenting the words, for the students were complete beginners. The presentations of the 15 German words to all the students in both treatments were the same; they took approximately 10 minutes; and the target words were presented using the Microsoft Office PowerPoint software program with the help of a projector. Thus, the students had the chance to see both the German words and their English equivalents with relevant pictures displayed on a white wall. The same teacher in each treatment spent around 30–40 seconds per word and was formally instructed to pronounce each German word several times and give its English or Georgian equivalent and then make the students repeat the target words several times.

2.4. Description of treatment

As far as the first treatment is concerned, after the students were presented with the fifteen German words and their corresponding pictures and translations, they were asked by the teacher to watch various video clips for 30 minutes whose aim was to simulate the immediate effects of mental pollution. The videos which they were asked to watch were highly rated and included scraps of violence, horror, eroticism, humor, slapstick comedy and other emotionally affecting imagery borrowed from several internet websites where users share uploaded videos. Many of the videos were commercial advertisements produced to promote and publicize goods and services ranging from brand name sodas to automobile manufacturers. As an example, one clip advertising a brand of soda featured an attractive young woman seductively kissing a young teen in order to win his can of soda. The young boy later confronted the woman with an even larger container of soda. Another clip featured characters from classic horror movies interacting with children and families. These videos and others like them acted as mental pollutants, in that they distracted the attention of the subjects with a great amount of affecting yet irrelevant information in a relatively short period of time. The clips were unorganized and presented to the students without any premeditated ordering or edits. According to both teacher observation and student commentary, the videos were described as variously humorous, disturbing, bizarre, comedic, sexually arousing, discomforting and emotionally affecting by most students.

Shortly after watching the videos, the students were tested for nearly ten minutes on the fifteen German words in which they where asked to match them to their English equivalents. Then their correct answers were counted and the data processed so that the

statistically important values were calculated. The same procedure was repeated by the same teacher in all three classes exactly in the same manner.

As for the second treatment, which took place a month later, the same 106 students in three different classes were presented with another set of 15 German words again by the same teacher. The first procedure, which lasted around 10 minutes, was repeated for the presentation of the target words in the same way. That is, one by one the German words and their English translations, including repetitions with pictures, were introduced to the students. Following this, the treatment the students received was different in that they were asked to listen to different music by popular composers of classical music: Ludwig Van Beethoven, Wolfgang Amadeus Mozart, Kitaro, Yanni, and Karunesh. Along with the music in the background, they were allowed to do free class work such as reading, painting, writing, and doing homework. As in the first treatment, students were given ten minutes to match the 15 German words to their English counterparts on the provided worksheets after the completion of 30 minutes and their correct answers were calculated.

3. Data analysis

As for the experimental design, the Equivalent Materials, Pretest, and Posttest Design (Best and Kahn 2006) was used because of its compatibility with the study, while the same groups acted as experimental and control groups and were subject to two treatments. In order to find the differences between the two treatments in the experiment in terms of students' retrieval of vocabulary items, the SPSS program was used to analyze the data. From the descriptive statistics, joint distribution and then paired sample t-tests was applied to the scores of students. The Kolmogorov-Smirnov Z test was also used to see if the scores, acquired from the two different tests of the same quality, applied to the same groups at different times, show normal distribution. The results of the analysis of both tests and their Kolmogorov-Smirnov Z test values are given below in Table 1.

Table 1. Kolmogorov-Smirnov Z test results for the two tests.

	Mental Pollution	Standard
N	106	106
X	4.26	9.52
Kolmogorov Smirnov Z	1.126	0.906
P	0.158	0.384

According to the Kolmogorov-Smirnov Z test analysis, the value for the results of the first treatment, which included mental pollution after language vocabulary learning, is

1.126; on the other hand, the value for the second treatment, which included classical music after the foreign language vocabulary teaching, is 0.906. That is, the estimates of the significance of the Kolmogorov-Smirnov Z test value are respectively 0.158 and 0.384, which confirms the expected hypothetical distribution. Within this test, a significance level of more than 0.05 means that the distribution is normal; therefore, in this study sample t-test from parametric tests is applied.

4. Results

For each one of the 106 subjects, two test results are provided: one after polluting their minds and one after they relax their minds with music. We will refer to the first experiment as "Pollution" (P) and the second one as "Standard" (R).

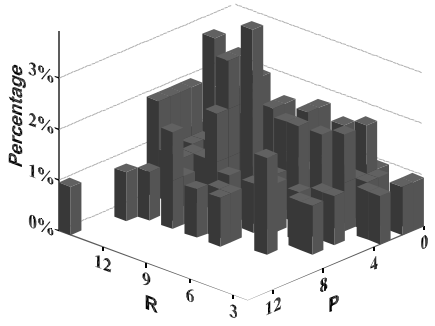

Figure 1. Histogram of the test scores of the 106 subjects (joint distribution).

The results of the t-test are given in Table 3 to see if there exists any significant difference between the scores of the same students with two different treatments: mental pollution and relaxation by music. According to the results in Table 3, there exists a significant difference between the two conditions of retrieving target words after watching bizarre videos and relaxing through music ($t=13.655$; $p<0.01$). The remarkable difference is in favor of the condition in which the students listened to music as they were engaged in free class work after the presentation of the target words and before they were asked to recall the words for evaluation purposes. As is easily seen in the same Table 3, the mean for the mental pollution treatment is 4.26; on the other hand, the mean for the standard treatment is 9.52, which confirms the hypothesis that mental pollution results in poor memory and performance.

Table 2. Test scores of the 106 subjects categorized into low, middle, and high (simplified version of Figure 1).

Test Type		Standard			Marginal sum
	Performance	Low	Mid	High	
After Mental Pollu-tion	Low	7	26	27	60
	Mid	2	17	25	44
	High	0	0	2	2
Marginal Sum		9	43	54	106

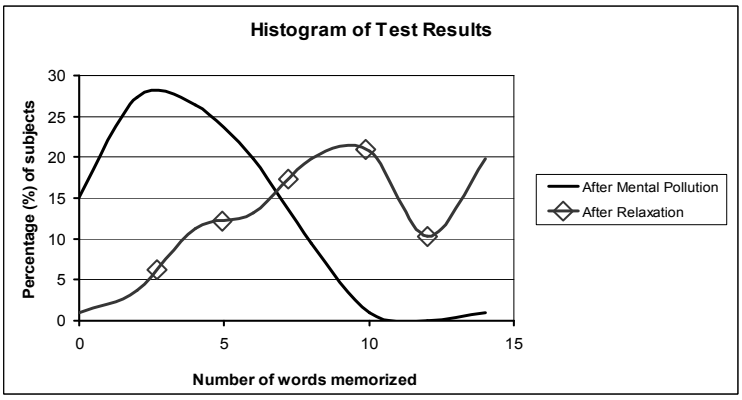

Figure 2. Marginal distributions of "P" and "S".

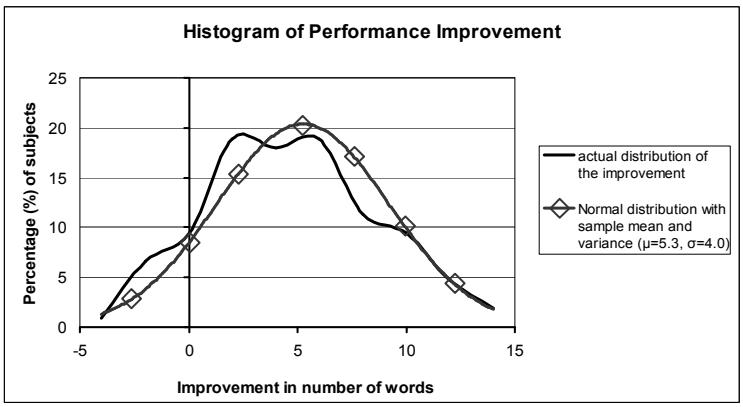

Figure 3. Distribution of the performance improvement when mental pollution avoided.

Table 3. Paired samples t-test on pollution and standard.

Test Result	N	X	Std. Dev.	Std. Error Mean	T	Df	p
Pollution	106	4.26	2.620	.255			
Standard	106	9.52	3.655	.355	13.655	105	.000

5. Discussion

The purpose of the present study was to investigate the effects of mental pollution on memory and language learning performance. The results of the study confirm the mental pollution hypothesis and its key role in learning, especially foreign language learning. In this short experimental study, the same 106 students were exposed to two different treatments with one month interval in between: (a) shocking, emotionally affecting, comedic and bizarre videos which served as forms of mental pollution; and (b) free time to engage in activities accompanied by light music by famous popular composers – just after they were presented with fifteen German words in each treatment. This study was conducted with adolescent students whose vocabulary gain scores were significantly lower after they were treated with mental pollution – various forms of intrusive and emotionally affecting visual stimuli such as videos as in this treatment. Parallel to this, the vocabulary gain scores of the same students were a great deal higher when they were not exposed to mental pollutants and were asked to listen to relaxing music for 30 minutes as they were involved in routine class activity such as reading, writing, doing homework, drawing and etc., which provided them with comfort and sharper memory.

This study also supports Krashen's (1985) Affective Filter hypothesis, according to which input is obstructed in reaching the Language Acquisition Device (LAD) when the learner lacks motivation, suffers from anxiety, and has low self-confidence. The findings of this study contribute largely to the Affective Filter Hypothesis in that they broaden the spectrum of affective variables by drawing our attention to the presence of mental pollutants. Mental pollutants, depending on their size, content, quality, and material, indeed act like a high filter which not only obstructs language acquisition, but also results in poor memory. Correspondingly, the same students in the study remembered significantly more words when they were treated with free time accompanied by music, which provided a physical and psychological relaxing atmosphere by lowering the Affective Filter. In Krashen's terms, because of the characteristics of the second treatment the filter was low; in other words, the presumed detrimental mental pollutants were absent, and therefore the musical condition may have greatly facilitated language acquisition. While the extent to which this may or may not have facilitated levels beyond normal memory performance in a completely silent atmosphere are not obvious, we believe that this does not invalidate our findings, and merely supports the call for

further research on both the effects of mental pollution as well as calming music on our various cognitive capacities.

Additionally, the negative effects of certain distractors such as TV and radio on learning performance have been confirmed in different settings and populations (Krupski 1980; Miller and Weiss 1982). For example, educators like Fenker (1981) and Keith (1986) assert that environmental distractors interfere with learning; thus, students should study in conditions away from TV, radio, and telephones. Similarly, Cool et al. (1994) found that students were able to complete fewer computational math and reading comprehension problems when working with the TV on than with the radio, or in silence. Consistent with prior research (Kubey and Csikszentmihalyi 2002), the present study is valuable in that it provides complementary insights by clarifying the contents of TV and internet distractors – mental pollutants – that may hamper learning. Probably, in connection with the current study, this explains why the students who were exposed to mental pollutants were very much less successful in the first treatment in comparison to the second. We believe this warrants further research.

The powerful effect of music on the brain has been known for many years. Researchers have been investigating the connection between music and state of mind: emotion, work efficiency, concentration, learning, and memory (North et al. 2004; Weinberger 2000). One popular study that examined the influence of music on work performance indicated the absence of music in the setting resulted in low quality of work (Lesiuk 2005). Likewise, McCraty (1998) looked for the impact of music on tension, mood, and clarity, and his findings confirmed the positive link between music and concentration, feeling, and mental clarity. In line with this reasoning, the results of the same study similarly, indicated that students when they are exposed to music have better memory and thus higher scores. Specifically, the replacement of mental pollutants with classical music after vocabulary learning seems to benefit students' overall comprehension: a highly anticipated condition which nevertheless illustrates the way in which one's affective state can be manipulated by external stimuli both to the gain and detriment of learning, depending upon the form and content of the stimuli. Therefore, the musical works of popular composers should be used in lieu of ineffective or otherwise distracting visual aids in teaching environments where maximum performance is required from learning, unless those aids are of a form known to positively facilitate learning.

To a great extent, all sorts of modern methodologies and the by-products to promote language learning seem to be hampered by different forms of overwhelming mental pollution. Even though they did not much know about contemporary language learning methodology and research, many past scholars and enthusiasts managed to learn countless foreign languages without much effort and resources. For example, Vatican librarian Cardinal Giuseppi Mezzofanti (1774–1849) is believed to have been able to speak 50 languages; Sir William Jones (1746–1794), known as an English philologist, is said to have known 28 languages; Jean-Francois Champollion (1790–1832) and Sir Richard Francis Burton (1821–1890) were other well-known polyglots who were able to com-

municate and read in many languages and dialects (Perry 2004). Their success is astonishing when we compare them to people in the present from different backgrounds, most of whom have problems in their mastery of only one second language despite the incentives brought on by globalization and increasing availability of resources and technologies. The implication for the present is that the polyglots from the past, besides their giftedness and enthusiasm, did not suffer from widespread mental pollution as much as contemporary adult language learners do. For instance, it may have been that the polyglot Mezzofanti was a prodigy in languages in part because he spent his life mostly in the church and therefore was not exposed to any form of mental pollution which would occupy his mind, distract his attention, and weaken his memory.

The implication for pedagogical practice in the present is that teachers should make their students aware of the potentially detrimental effects of mental pollutants. While it is admittedly impossible to prevent learners from watching TV, playing video games or surfing the internet for excessive periods of time, and while keeping in mind that media can play a positive role for language learners and for people in general, no harm can be done from simply informing them of the possible harm and loss of time incurred by overly excessive engagement in such activities, and encouraging them to make time management decisions accordingly. Additionally, teachers must be mindful of the how the technologies they have come to regularly utilize as learning tools in the classroom may impair certain aspects of language learning. While certain media-based technologies provide instructors with a host of new and exciting sources from which to draw resources, and while many media sources such as the internet and television in many ways provide invaluable resources which can be employed in the classroom with great success, our study shows that certain forms of such media employed in certain situations seem to have a detrimental effect on some cognitive tasks, such as memory retention. Teachers should be aware of this, and should craft their lesson plans and classroom activities accordingly.

5.1. Limitations

On the other hand, the present study included a student sample that represented only freshman university students around the age of 18–20, and further research with other populations, settings and different levels of mental pollution may produce different results. The fact that cable, internet, and satellite TV, video games and movies on DVD or online, and wireless internet access have become part of daily life means that more studies are called for to investigate how much each of these ever-changing technological devices can impact learning.

Furthermore, the experiment in this study was limited only to two sets of fifteen German words (in total 30 words) with a one-month interval to measure the immediate effects of mental pollution on memory and language learning. In order to strengthen the hypothesis, supplementary research is necessary to examine the relationship between

mental pollution and foreign language learning over an extended period of time and with extensive vocabulary sets including other foreign languages. As is the case in this study, the results of studies that include other language skills such as grammar and reading and other disciplines like mathematics and literature to find out the impact of mental pollutants may be promising, indeed.

A pre-test was not included in the study, for the students did not know the German language at all, particularly the chosen words. On the other hand, the unavailability of the students and conditions later on prevented the application of a post-test whose results would be statistically meaningful for the study after a long period of time. Thus, other experiments that aim to focus on mental pollution may reach valuable outcomes when they take the time factor into consideration.

The presence of music in the standard treatment may also be argued to have interfered with the results, on the grounds that some studies have found music to facilitate memory and language learning. While there may be some ground for such objections, we believe that they do not invalidate our findings. The music present in the standard treatment was not the focus of the treatment; indeed, students where allowed to do as they pleased in the interim time between receiving and reciting the target vocabulary. Furthermore, it is thought that music facilitates learning because it has a cleansing effect on the mind and emotions; if this is so, it merely highlights the ways in which mental pollution, as a kind of unnecessary and emotionally affecting cognitive clutter, inhibits learning; if a clear mind and relaxed mood reinforced by music or free time facilitates learning, whereas mental contaminants do not, this merely serves to further validate and even elucidate our findings.

Finally, while it may be argued that the study is handicapped by its reliance upon translation and memorization, thus defining language acquisition in a manner that is somewhat narrow and out of vogue, we nevertheless believe that the study is not invalidated on these grounds. Rather, we believe that memorization and translation are part and parcel of language acquisition proficiency, and that they are acceptable because they are the most commonly utilized and practically implemented key components of the early learning process for any second language learner (if not also for first language learners, albeit in a different manner). This is especially true of memory, which is necessary for acquiring any form of lexical reference system such as a second language. Furthermore, we do not seek to invalidate or directly challenge the majority of other language acquisition theories, but merely to augment them by noting one factor in how a person's environment can alter his or her ability to learn. No doubt there is a period when the mind is most suited to language acquisition, and doubtless immersion is a valuable aid to language learning; however, this does not mean that second-language acquisition and native-like proficiency after that period or without immersion is impossible, nor even improbable, provided there is proper motivation, access to materials, and above all the relative absence of distracting mental pollutants.

6. Conclusion

The results of this study indicate that mental pollution – so far an overlooked but very serious handicap which is a very common phenomenon among adults (if not children to some extent as well) attempting to learn an L2 – is a crucial reason among many others for their failure in learning foreign languages and other subjects such as math and history. Therefore, the pedagogical implications of this study are worthy of consideration, for they address not only researchers and language teachers, but also those who are pursuing other social studies and scientific disciplines as well. This experimental study has shown that for success in any discipline (academic or non-academic) and life where memory is inevitably involved, awareness of mental pollution is necessary. As long as we fail to judiciously limit our exposure to various forms of mental pollution – ineffectual use of the internet; excessive TV watching; constant over-exposure to distracting visuals; unnecessary and unorganized information over-load – depending upon the intensity of such input, the learning of new material will become very difficult, demanding, and time-consuming; and forgetting will always be unavoidable.

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