

## THE EDUCATIONAL TECHNOLOGY FOR LEARNING FOREIGN WORDS

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**Abstract:** German psychologist Hermann Ebbinghaus, the first person studied a memory, experimentally publishes his forgetting curve, which characterized the ability of a human brain to remember the information. He proved experimentally that during the first hour of learning process 60 percent of information is forgotten and after 10 hours of workload our memory abandons 35 percent of information. Then forgetting process become slower and after six days our memory abandons near 20 percent of the learning material. As a result of the research Hermann Ebbinghaus has suggested the algorithm of the effective learning. Based on the modification of the algorithm we have created a special service for learning foreign words called WordSteps. It allows to learn more than 97 percent of new information even in a year after the first training.

**Keywords:** Memory, natural language processing, learning words

**ACM Classification Keywords:** I.2.7 Natural Language Processing

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### Introduction

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There is an effective method of learning new foreign words. Person just must devote 15 minutes a day to learning. This project has special algorithm, that helps to learn foreign language systematically and efficiently. As we can observe from different linguistic researches and studies, learning new information will be effective if the information we have to learn would be refreshed in our memory at the right time intervals. WordSteps offers a big collection of dictionaries available on the website in 30 different languages: English, Russian, French, Spanish, Chinese, German and others. Project gives an opportunity to find a dictionary or create a new one. Every dictionary could be rated by users. Such system allows members to choose a dictionary of required quality and difficulty level. Next step is to repeat the words person has learned a few days ago. So we can observe a spacing effect in psychology which means that information learned during a long period of time is much better retained than information which is intensively learned during a short period of time. Thus the basic way to success is determined by repetition and regularity.

The list of competitors:

- SuperMemo is a method of learning the information. Their slogan is “everyone can learn effectively” and “forget about forgetting”.
- Smart.fm -> iKnow.jp is a service for learning words. This project has one of the best algorithm of learning. The attendance of this web site is about 60 th/day.
- Quizlet.com- quite old service for learning a new words. It has an open API, Android and iPhone applications. Monetization- is a paid subscription for expanded possibilities. It is not so good at algorithm and simplicity of using, but it is quite popular. The attendance is near 45 th/day. More than one million of registered users.
- Livemocha.com- is one of the biggest social language network. It has the same principle with a busuu.com, with a sale of thematic courses. More than 8 mln of registered users, the attendance is near 200 th/day.

- Rosetta Stone- is a company that produce on-line and soft services for learning foreign languages. It has their own methods of studying. It uses only pictures without translation.

Our project has a number of advantages:

- The best algorithm, based on experimentally proved methods;
- Simplicity in use;
- Availability on web and mobile applications;
- Presence of only base of knowledge and pass-rate.

**Project Description**

In psychology, the spacing effect is the phenomenon whereby humans more easily remember or learn items in a list when they are studied a few times over a long period of, rather than repeatedly in a short period [Shaw, 1995].

According to Fig.1, this algorithms work by following principle: you are offered to remember a number of words, if you manage with it successfully, the time of future repeating increase [Ebbinghaus, 1885]. But if you forgot the words and you can't remember them ,repeating interval sharply decreases. To learn the words successfully you should use them in different ways such as: reading, writing, listening.

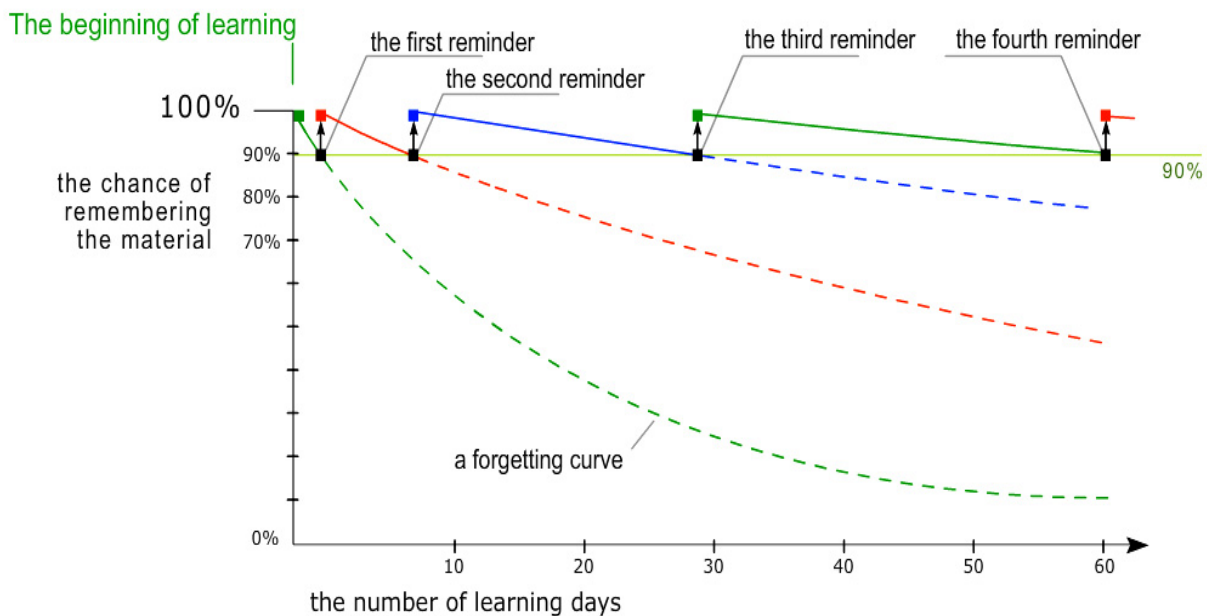


Fig.1. Forgetting Curve

WordSteps - personal vocabulary manager with a quite simple idea: invest 15 minutes a day visiting this website and in return get about 20 new foreign words remembered. It appears that, according to linguistic researches and studies, the most efficient way to learn foreign words is by memorizing not more than 20 words a day. Multiply this number by 365 days and get more than 7000 words in one year. Taking in account that normally no one wants to study every day and the best scenario is once in two days, we get a little more than 3000 words. According to statistics that amount of words is enough to understand 80% of all foreign books, newspapers and movies, and this is more than enough to hold day to day conversations with foreigners.

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## Methodology

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To learn new things you should plan your lifetime capacity. The following information has some scientific aspects concerned learning words.

The number of words memorized in consecutive years when working one minute per day can be approximated with the following equation [Wozniak P. A., Gorzelanczyk E. J., 1994]:

$$\text{NewWords} = r * (3 * e^{-0.3 * \text{year}} + 1), \quad (1)$$

where :

- NewWords - words memorized in consecutive years when working one minute per day,
- year - ordinal number of the year,
- r - asymptotic acquisition rate, i.e. the minimum learning rate reached after many years of repetitions (usually about 150 words/year/min).

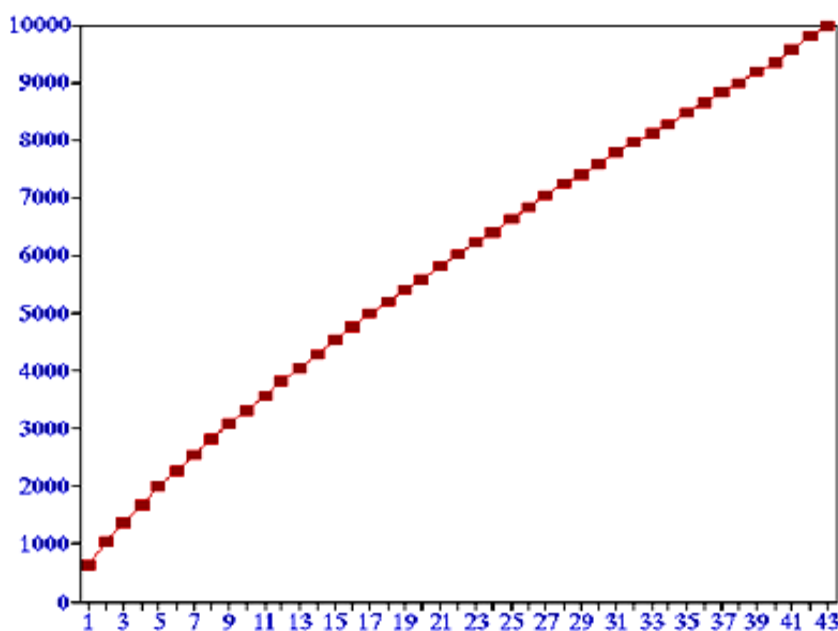


Fig. 2. Learning curve for a words, forgetting index equal to 10%, and daily working time of 1 minute  
\*Axis of abscissae is a year; Axis of ordinates is a total number of memorized words.

For a generic material and the forgetting index of about 10%, the function of time required daily for repetitions per word can be approximated using the formula [Wozniak, 1994]:

$$\text{time} = 1/500 * \text{year}^{-1.5} + 1/30000, \quad (2)$$

where:

- time - average daily time spent for repetitions per word in a given year (in minutes),
- year - year of the process.

For example, the total time for a 3000-words collection in the first year will be

$$3000/500 * 1 + 3000/30000 = 6.1 \text{ (min/day)}$$

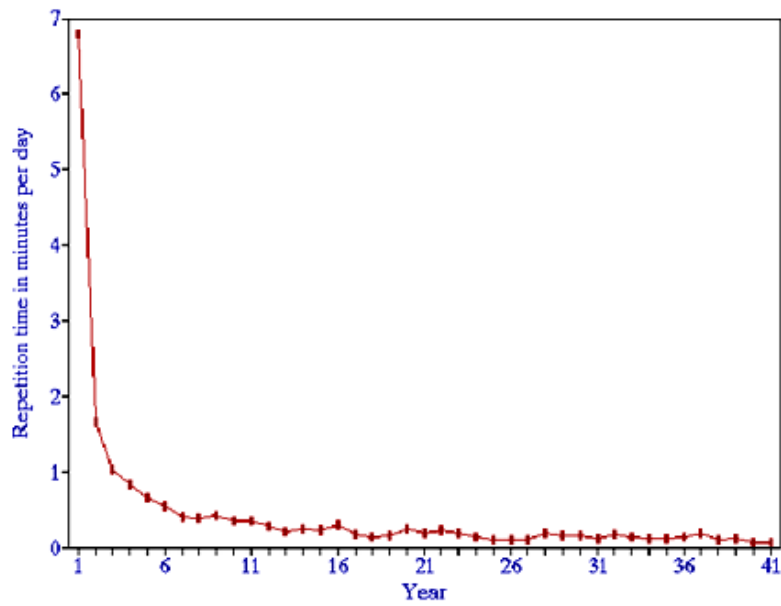


Fig. 3. Time, in minutes per day, in a generic 3000-words learning material, for the forgetting index equal to 10%

The forgetting index and knowledge retention can accurately be described using the following formula:

$$R_t = -\ln/\ln(1-in) \tag{3}$$

where:

- $R_t$  - overall knowledge retention expressed as a fraction (0..1),
- $in$  - forgetting index expressed as a fraction (forgetting index equals 1 minus knowledge retention at repetitions).

The above formula can be derived from the formula for the exponential decay of memory traces ( $R=e^{-d*t}$  where  $R$  - retention,  $d$  - decay constant,  $t$  - time).

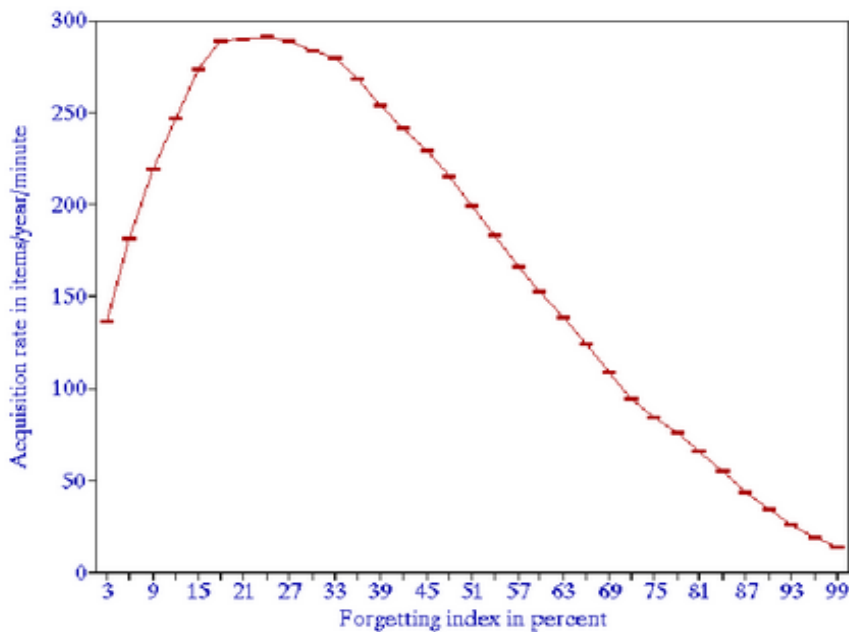


Fig. 4.- Dependence of the knowledge acquisition rate on the forgetting index

The recommended value of the forgetting index used in the practice of learning is 6-14%.

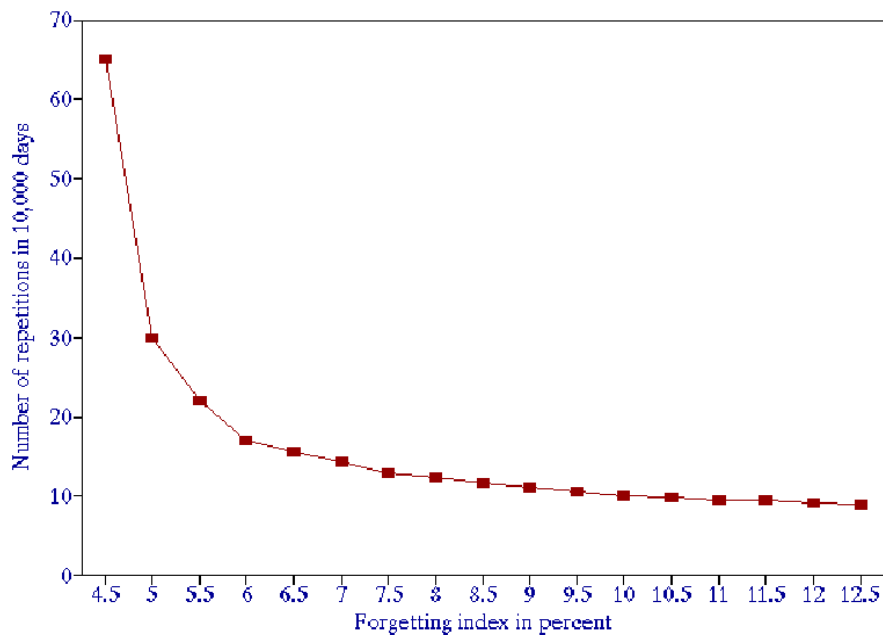


Fig.5. Trade-off between the knowledge retention (forgetting index) and the workload (number of repetitions of an average item in 10,000 days)

As compared with equally spaced repetition schedules, for the forgetting index equal to 10%, in the period of 50 years, the discussed model produces an about 50-fold increase in the speed of knowledge acquisition (i.e. speed of learning)

The following table illustrates the proportion of time spent on repetitions of material characterized by a different number of memory mistakes:

Table 1. Proportion of time spent on repetitions of material characterized by a different number of memory mistakes

Number of mistakes	Percent of words	Percent of time
0	62%	42%
1	16%	16%
2	9%	15%
3	5%	9%
4	3%	6%
5 and more	5%	12%

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## Conclusion

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Today WordSteps offers more than 40.000 dictionaries and 30 languages to learn. Such a great amount of UGC (User Generated Content) is available because people really get the great results while learning process and the reminder system via e-mail get the motivation on a high level. Users can also use mobile apps to learn words on the go. Now iPhone, Android and Bada Apps are available. WordSteps offers the special e-learning platform for teachers, who can share dictionaries with students and check their mistakes.

Nowadays people have so little time to spend it for learning languages and the WordSteps project is aimed to solve this problem and make the process effective.

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Major Fields of Scientific Research: mathematical modelling, data mining