Computational Model of False Recall

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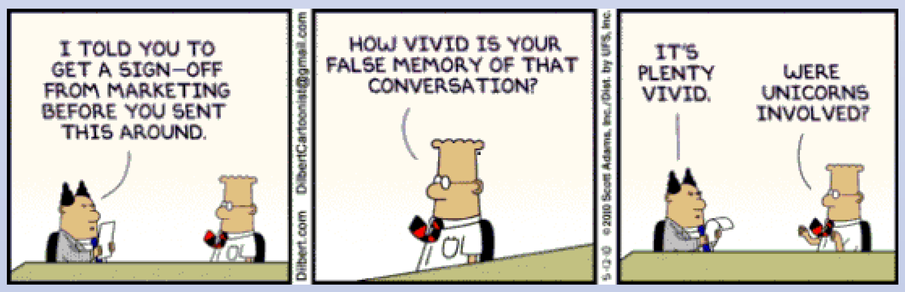
INTRODUCTION



http://www.markhowelllive.com/wpcontent/uploads/2012/07/false_memory-e1342143637727.gif

What is False recall ?

Having false memory of an event or incidence that didn't happened is False recall. The motivation behind studying this problem is to gain more and more information about how our memory works.

To study the process of false recall the subjects are presented a list of words strongly related(semantically) to the non presented critical word, and are asked to recall as many words as possible.

COMPUTATIONAL MODEL

In this project we build a computational model which takes into account the following things.

- Storage Process –
  - Rehearsal increases the association of the words in the buffer(STM) with the context by a fixed parameter a.
  - Also increases the episodic associative strength between any two items in the buffer by fixed values b1 and b2.
  - STM is expected to have size r, which has its mean at 4.

- Semantic Encoding mechanism–

  Increment in the context association for each word in the lexicon proportional to
  - The sum of the strength of the word semantic association to all the items in the buffer

$$S(i, context)_t = S(i, context)_{t-1} + a_s \sum_{j}^{j \in M} S_s(i, j),$$

Image Source: [1]

  - The product of the stren[illegible] to all the items in the buffer

$$S(i, context)_t = S(i, context)_{t-1} + a_s \prod_{j}^{j \in M} S_s(i, j)$$

Image Source: [1]

- Retrieval Process –
  - The retrieval from the long term memory uses association with context, episodic association and Semantic association(used WAS for Semantic associations). For the add option in retrieval process we use the formula given below, a similar formula is used for the product retrieval process

$$P_s(i|context, j \in M) = \frac{S(i, context)^{W_c}\left(\sum_{j}^{j \in M} S_e(i, j)\right)^{W_e}\left(\sum_{j}^{j \in M} S_s(i, j)\right)^{W_s}}{\sum_{k}^{k \in N}\left[S(k, context)^{W_c}\left(\sum_{j}^{j \in M} S_e(k, j)\right)^{W_e}\left(\sum_{j}^{j \in M} S_s(k, j)\right)^{W_s}\right]},$$

$$P_r(i|context, j \in M) = 1 - e^{-[W_c S(i, context) + W_e(\sum_j^{j \in M} S_e(i, j)) + W_s(\sum_j^{j \in M} S_s(i, j))]},$$

Image Source: [1]

RESULTS

The results we obtained

i) Using Add for both encoding and retrieval.

```
>> recall

recall =

  Columns 1 through 9

    0.6603    0.2304    0.6281    0.5694    0.3970    0.4859    0.6601    0.6584    0.5929

  Columns 10 through 14

    0.5468    0.5185    0.6084    0.6124    0.5059

>> wordlist

wordlist =

  Columns 1 through 7

    'QUEEN'    'ENGLAND'    'CROWN'    'PRINCE'    'GEORGE'    'DICTATOR'    'PALACE'

  Columns 8 through 14

    'THRONE'    'CHESS'    'RULE'    'MONARCH'    'ROYAL'    'LEADER'    'KING'

fx >>
```

Wordlist source: [2]

ii) Using multiply for both encoding and retrieval.

```
>> recall

recall =

  Columns 1 through 9

    0.9350    0.7084    0.9629    0.7078    0.7064    0.7903    0.9729    0.9801    0.7186

  Columns 10 through 14

    0.7142    0.8382    0.9120    0.7384    0.9246

>> wordlist

wordlist =

  Columns 1 through 7

    'QUEEN'    'ENGLAND'    'CROWN'    'PRINCE'    'GEORGE'    'DICTATOR'    'PALACE'

  Columns 8 through 14

    'THRONE'    'CHESS'    'RULE'    'MONARCH'    'ROYAL'    'LEADER'    'KING'
```

Wordlist source: [2]

CONCLUSIONS

- The model suggests that episodic strength, context association, word association triggers the false recall. This is triggered both during the retrieval and the encoding process.

- We see that using multiplication for encoding and retrieval gives a false recall value of 0.92 which is higher than in the case of using addition for encoding and retrieval (0.50), this matches with the results found by Kimball and Smith.

REFERENCES

[1][Daniel R. Kimball, Troy A. Smith, Michael J. Kahana] "The fSAM Model of False Recall", *Psychological Review* 2007 Pg 954-993

[2][Henry L Roediger, Kathleen B. McDermott] "Creating False Memories: Remembering Words not presented in Lists ", *Journal of Experimental Psychology, Learning Memory and Cognition*, 1995 pg 803-814

[3][Steyvers M., Shiffrin, R.M., Nelson, D.L. "Word Association Spaces for Predicting Semantic Similarity Effects in Episodic Memory". In A. Healy (Ed.), *Experimental Cognitive Psychology and its Applications*. , 2004