

Introduction

The study of how the human brain consumes information, and the mechanism used to both store and retrieve that data is a highly acclaimed academic field that has its roots dating back to the early 20th century. Over the century since then, significant studies and dissertations dedicated to uncovering the secrets of the brain have been produced. This discipline is called Cognitive Neuroscience with an entire key section dedicated to Memory and determining what type of data humans memorise and recall.

Mind Matters

From many studies and experiments performed by Neuroscientists, a popular theory called dual coding (Paivio, 1969, 1983, 1986) emerged which states that graphical objects such as pictures, images or shapes are better remembered than words or number sequences. The rationale behind this theory is that pictures, images and shapes are encoded (memorised) with 2 specific codes (pictorial and verbal) whilst a word or number sequence are encoding using a single verbal code. This technique is also known as the Mnemonic Peg System where you associate the number 1 to an image such as a spear, 2 as a swan etc. The additional encoding form provides the brain more stimuli and ultimately leads to better memory recall. These improvements extended to long term-memory recall as well as the short-term memory recall.

Building onto the Paivio theory, Weldon and Roediger (1987) claimed that the more data was encoded with conceptual processing the better it would be recalled. Pictures and shapes have more conceptual encoding than words and numbers and therefore are easier to remember. The results of this study showed a marked improvement in the cognitive ability of a controlled test group when recalling pictures as opposed to words. The full study is available at:

<http://www.springerlink.com/content/v3ql3t2483234114/fulltext.pdf>

Nelson (1979) suggested in his sensory-semantic model that although pictures and words share identical semantic codes (meaning), pictures are more memorable because they have more distinctive sensory codes than words.

Additional studies within the Neuroscience community show that people both think & read in shapes, not letters & words. It is for *tihv vrey raeosn taht you sohlud hvae no prlboem redaing tihs snteence dsetpie the dieleberte eorrrs*. The premise to this belief is that our thoughts and language are broken down into shapes / patterns and stored & recalled as such. When reading the earlier sentence with so many obvious flaws, provided the first letter and the last letter within the word are correct, the rest of the word's shape is what the mind expects and therefore can be decoded (read) accordingly. Experienced journalists and proof readers even make errors in headlines as mixed up letters in words can be hard to consciously spot.

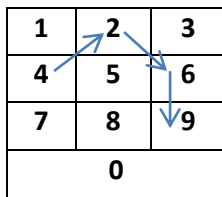
As a result of these studies, popular memory improvement techniques such as Graphical and Textual mnemonics have become well proven aids to assist people with memory recall and are particularly popular with students the world over. The results of the studies conclude that words are easier to recall than numbers, and pictures / shapes / patterns are easier to recall than words.

Real-world pattern recall

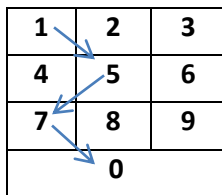
Without consciously realising why, people tend to realise that they indeed have greater recall of patterns over numbers. An everyday real-world scenario that we can all identify with is drawing cash from an Automated Teller Machine (ATM). Typically, ATMs require a 4 digit PIN number to prove who you are. A 4 digit PIN should be simple to remember, however most people enter a pattern sequence on the keypad instead of thinking about the actual PIN number.

Below are 2 examples of how the majority of people would remember their PIN code by visualising the keypad and “drawing” the pattern that they would follow when entering the PIN.

Example 1 : 4 2 6 9



Example 2 : 1 5 7 0



Interestingly some banks have previously experimented with moving the numbers around on an electronic keypad in an attempt to prevent shoulder surfing of PIN numbers. Unfortunately this broke the user’s pattern based recall process of the PIN numbers and led to an increase in swallowed bank cards and the system was abandoned.



pin+ leverages the mind’s ability to use patterns

In the random ATM electronic keypad system filed simply because it worked against the minds ability to work with pattern and assumed it was easier to work with numbers. pin+ turns this concept on its head by making the pattern the thing that is remembered and not the numbers. With pin+ the numbers change randomly each time you use it, but the pattern remains the same.

pin+ users are shown a matrix (typically 6x6) of pseudo-randomly generated numbers which change every minute. Users only need to remember a pattern of at least 6 squares, no numbers at all. A user can choose any pattern and can even use the same square more than once. While this is simple for the user to grasp, it is also highly secure as there are billions of unique combinations.

For example, assume that the user’s pattern is “L” shaped starting from the top middle of the red section, and they are given the following challenge matrix (The arrows show the user’s pattern):

4	0	4	2	3	5
1	2	5	0	2	3
3	2	5	0	1	4
5	3	1	4	5	2
3	2	0	1	5	0
1	3	1	4	4	1

In this case, the user’s PIN code is **0 2 2 3 1 4**

After this PIN has successfully been used, the code cannot be used again.

Next time around, the challenge matrix will be different and thus the PIN number will also be different, however the user’s pattern doesn’t change. At their next login the challenge matrix may be as follows:

0	3	4	1	1	2
3	1	2	5	4	3
4	5	3	4	4	0
2	5	4	3	0	2
5	2	1	5	1	0
0	0	4	3	1	2

And this time around the user’s PIN is **3 1 5 5 4 3**

Final thoughts

In summary, pin+ has been purposely designed to harness the natural way the human brain works best for remembering and recalling information. This means that more complex information can be remembered by the user which leads to much stronger security, however it also means less frustration for the user as it is actually more natural to use.