Pattern Based Authentication

More than a mind game

Whitepaper
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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 this very reason that you should have no problem reading this sentence despite the deliberate errors. The premise to this belief is that our thoughts and language are broken down into shapes / patterns and stored and 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 withdrawing 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**

![Keypad Example 1]

Example 2: **1 5 7 0**

![Keypad Example 2]

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 ultimately resulting in the system being abandoned.
**PINgrid leverages the mind’s ability to use patterns**

The random ATM electronic keypad system failed simply because it worked against the mind’s ability to work with patterns and wrongly assumed it was easier to work with numbers. PINgrid turns this concept on its head by making the pattern the thing that is remembered and not the numbers. With PINgrid the numbers change randomly each time you use it, but the pattern remains the same.

PINgrid users are shown a grid (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 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 grid (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 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 grid 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 grid may be as follows:

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

This time around, the user’s PIN code is **3 1 5 5 4 3**

**Final thoughts**

In summary, PINgrid 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 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.
About Authlogics

Authlogics provides IT security professionals with a fresh alternative to legacy authentication and transaction verification methods. We help companies remove the reliance on password-based authentication and hardware tokens, and encourage the use of self service capabilities. We eliminate costs and administration surrounding card readers and keyring tokens, and innovate without the need to implement expensive biometrics.

Whether you want to authenticate to a Web portal, VPN, firewall, or to a multitude of different Cloud providers, Authlogics offers a range of authentication methods to suit your business. Our solution provides 1.5, 2 and 3 Factor Authentication options, via three authentication technologies (PINpass, PINphrase & PINgrid) and can be delivered via the Web, Mobile App, Email or SMS/TEXT. Additionally, we have several integration agents for various 3rd party systems should you need them.

PINgrid

PINgrid is an award-winning and patented multi-factor authentication and transaction signing solution that is being used in the public and private sector today to transform any mobile device into a soft-token, via a simple offline application, replacing passwords with a memorable pattern that automatically generates a One Time Code (OTC).

PINphrase

PINphrase is a memorable word technology where users are asked for random letters from answers they already know to log in, instead of providing a full password. PINphrase is the only off-the-shelf solution that delivers this type of technology used by many banking web sites.

PINpass

PINpass is a 2 and 3 Factor OATH compliant 6 - 8 digit random code solution. This standard is widely adopted by many vendors and is well trusted. PINpass turns a mobile device into a token via an App or by sending an OTP via SMS or e-mail. Like most OATH solutions, PINpass works with a fixed PIN code which must be remembered, however it can also be used with an AD password or work in PIN-less mode.