

Musipass: Authenticating me softly with “my” song

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1. Introduction

Accessible authentication over the web is an under-represented area in security research. Our aim is to develop an authentication system to complement existing schemes, plugging the accessibility gaps left behind.

1.1. Accessibility: Using music as the basis for a password alphabet is potentially useful. Like images, a musical password can be designed to utilise cued recall and they could be used when a traditional scheme is unsuitable due to memory or cognitive impairments. Musical passwords could also be used by the visually impaired, or when there is no GUI available (e.g. over the telephone).

1.2. Security: Headphones can be used to help prohibit observation attacks, requiring less effort than shielded image-based schemes. Depending upon implementation, the alphabet can be large and can differ between users and systems, this way we might offer enhanced protection against offline brute-force and dictionary attacks.

1.3. Memorability: Musical passwords should (in theory) be memorable. It has been argued that music enhances memory formation, and is processed at a lower level than other semantic memories, suggesting that it may be less prone to interference than other forms of memory trace [3].

1.4 Pleasure: Most people enjoy listening to music. Brain scans show that when people listen to a piece of music that they like, areas associated with pleasure are activated [1]. Lazarsfeld and Field [2] carried out an experiment to determine preferences for one of three types of music: popular, classical and *old familiar*. They surveyed 2200 people and found that 76% liked to listen to music and, of those, 16% favoured familiar music. Lower percentages preferred the other music types.

2. Method

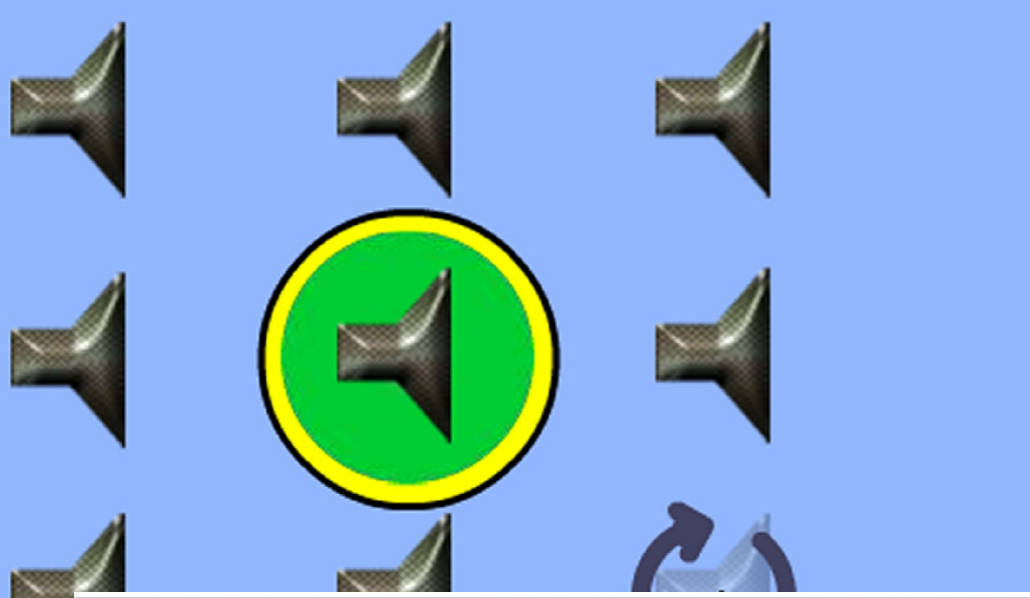
A cued recall-based musical password system called, “Musipass” was developed and populated with old familiar clips. Participants were invited to enrol and authenticate to a Web site. For comparison, they were also asked to create a naively selected traditional password that they had not used before. Quantitative data such as, number of errors, and password elements selected was recorded. We refer to this as, “phase one” of the experiment.

A week later, participants were sent an email requesting them to return and attempt to log in again using both sets of credentials, we refer to this as, “phase two”. Users were “locked out” of the system prior to this email being sent. On completion of both phases, participants filled out a questionnaire, including questions about demographics, and their reactions to the Musipass system.

We decided on a short password sequence of 4 clips being selected from a set of 36 presented over 4 screens. Although this would not provide a sufficient level of security in most “real-world” scenarios, it would allow us to establish a baseline with which more secure configurations can be compared in the future.

Password setup screen 1 of 4

- 1) Roll over the speaker icons to listen to song clips.
- 2) Select your favourite by clicking on it.



Left:
Musipass
password
selection
screen.

Training activity for password clip one

Listen to your first selected clip by hovering over the sound icon, then use the space below to make notes. This will help you remember it later.

Note: Descriptions are not made available during log in.

This song clip is the hippy hippy shakes. I picture teenagers doing the hippy shake dance to it during the 60's

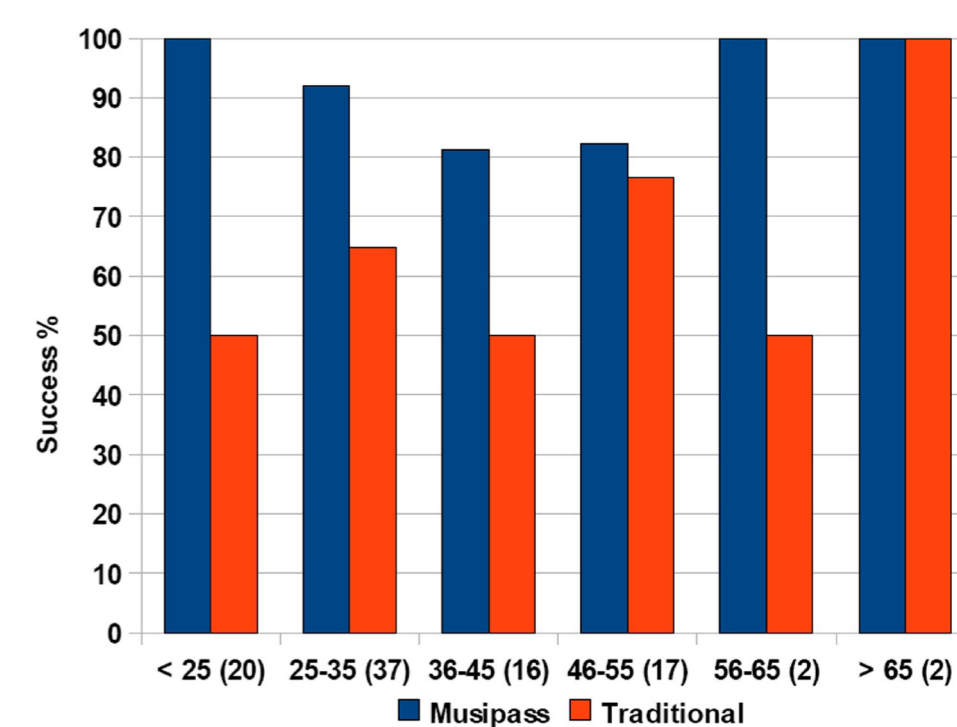
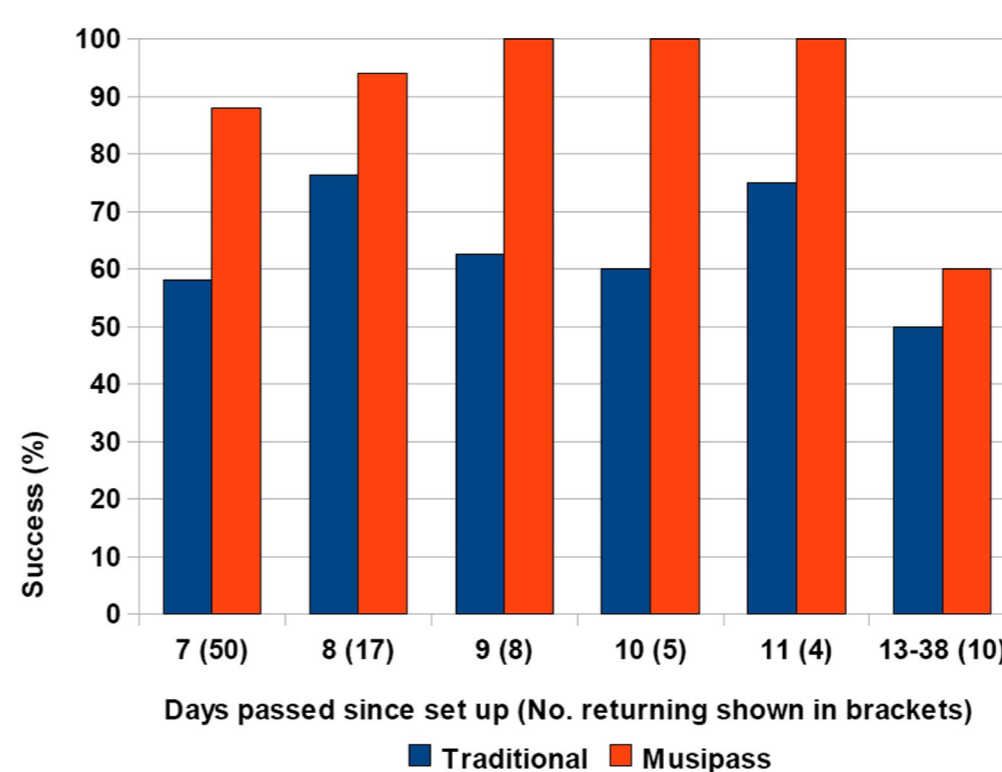


Right:
Musipass
training
screen.

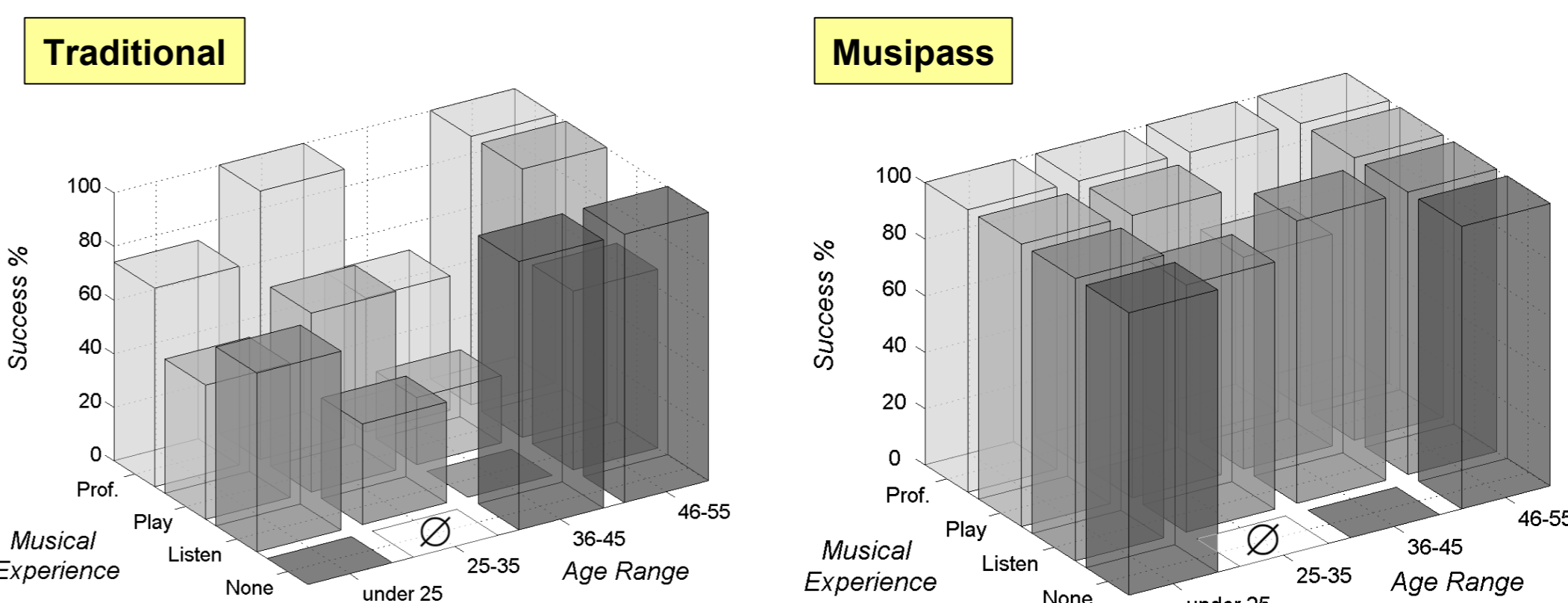
I'm finished, take me to the next sound

3. Results

Participants returned for phase two between 7 and 38 days after initial enrollment. Overall we observed a **91%** log in success rate with Musipass at phase two. For traditional passwords this was **62%**.



Data was isolated from participants returning on the 7th day for phase two - removing the days passed variable. There was no identifiable correlation between age and memorability in Musipass. We found that there was a correlation between musical experience and success rate. However, this effect was also observed in traditional password success rate, suggesting that level of musical experience not only affects the ability of music clip recognition, but the memory as a whole.



Above: Log in success rates from 7th day returners, grouped by age and musical experience

Overall, Musipass supported a larger proportion of users toward their goal of successful authentication throughout all subcategories analysed. Regardless of age and musical experience, we can therefore conclude that users are more able to authenticate successfully with Musipass than with a traditional scheme after a period of disuse.

Pros and Cons (from questionnaire feedback):

- ✓ Users liked the idea and enjoyed using songs to authenticate.
- ✓ Users found the system easy to use.
- ✓ Users could recognise their password clips easily.
- ✗ Users voiced concerns as to guessability.
- ✗ Too time consuming.

4. Future Work

We used old familiar tunes in our prototype. One question is, whether it is possible that a previously unfamiliar tune might become familiar with use and whether users would persevere with it long enough to reach this point.

Another question relates to scalability. How many musical passwords can people remember? Is there a way to ensure music clips on one web site differ from those on another? If not people might become confused, as they select clips that are familiar, but incorrect in the wider context. SSO may well provide a solution here.

We received, anecdotal evidence that people do not find the distractor clips becoming as familiar to them as their password clips. Our study involved a lengthy delay between enrollment and authentication. Trials involving regular use, perhaps on a daily basis, might be better placed to confirm this as fact.

Although many users found Musipass too time consuming, the question remains as to exactly how long it took. Repeating the experiment in a lab-based environment could provide better data for analysis. A related question is whether there is a way to make Musipass authentication faster.

Finally, ours was one possible implementation for a musical password. It should also be possible to design music-based systems differently that also offer enhanced security and memorability. We hope to have provided a good starting point for work in this field.

References:

- [1] A K Engel and W Singer. Temporal binding and the neural correlates of sensory awareness. *Trend Cognitive Science*, 5:16–25, 2001.
- [2] P Lazarsfeld and H Field. *The People Look at Radio*. U.N.C. Press, 1946.
- [3] K R Scherer and M R Zentner. Emotional effects of music: Production rules. In P N Juslin and J A Sloboda, eds., *Music and emotion: theory and research*, pp.361–392. Oxford University Press 2001

To learn more about the Musipass, see: Gibson, M., Renaud, K., Conrad, M. and Maple, C. Musipass: Authenticating me softly with my song. In *Procs. New Security Paradigms Workshop (NSPW'09)*, Queens College, Oxford, United Kingdom, Sept 8-11 2009. ACM. Or, try the demo!