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♪ Rhythm Based Authentication

Introduction

These days we are surrounded by things that require passwords. Everything from our Facebook accounts and smartphones to the locks on our homes require some combination of letters, numbers and symbols to be entered before we are authorized. On top of that, it is recommended that they are different from each other, making them very difficult to remember. For this reason we are suggesting using rhythm based authentication as an alternative to traditional written passwords. It is shown that most people are able to connect specific songs or rhythms to memories to a much larger extent than they can with texts [1]. Furthermore, rhythmic patterns have been used to identify people for decades. According to research from 1895, telegraph operators could be identified by their distinctive way of keying Morse code messages [2].

The research questions for this topic will focus on a few key concepts. Firstly, whether rhythms really are easier to remember. Secondly, how such an implementation could improve the accessibility of authentication, especially for blind people and the elderly. And thirdly, how visualizations could further improve the ability to remember one's password.

Challenge

All concepts presented on the following pages will try to accomplish Challenge 1: Digital Authentication and Access.

References

1. Lippman, J. R., & Greenwood, D. N. (2012). A Song to Remember: Emerging Adults Recall Memorable Music. *Journal of Adolescent Research*, 27(6), 751–774.
2. Umphress, D., & Williams, G. (1985). Identity verification through keyboard characteristics. *International Journal of Man-Machine Studies*, 23(3), 263-273

Concept 1
Design for the real world, Accessibility

Research questions

1. Can rhythm-based authentication be used to improve accessibility for blind people?

2. Can rhythm-based authentication be used to improve accessbility for elderly people?

# Rhythm-based Passwords for Improved Accessibility

The first concept is using approach 1, design for the real world. In this concept the idea is to improve the accessibility of authentication methods for people with certain disabilities, such as people who are blind or have low vision, or people who suffer from forgetfulness.

The plan for performing this concept is to first do some desk research on common problems with authentication in the target group. We will also hold a few interviews to get more in-depth knowledge. The next step would be to develop around 5 - 10 prototypes that will be tested on people within the target group. Some of these prototypes will be quite similar, but some will have to be vastly different from each other in order to be fully optimized for people with vastly different disabilities. For this reason the end result will most likely consist of more than one prototype.

Some research has already been made into this subject. For example an article by Daniella Faustino [1] which, among many other things, states that roughly 96% of blind people surveyed think passwords are important or very important to protect their personal information (Figure 1). But also that at least 61% of the same blind people surveyed are concerned about the safety of authenticating themselves in public spaces (Figure 2). Another article touching on this topic is written by Shiri Azenkot et al. [2]

The importance of passwords to protect their personal information among blind people surveyed

● Very important, important ● Neutral
● Not important, not at all important
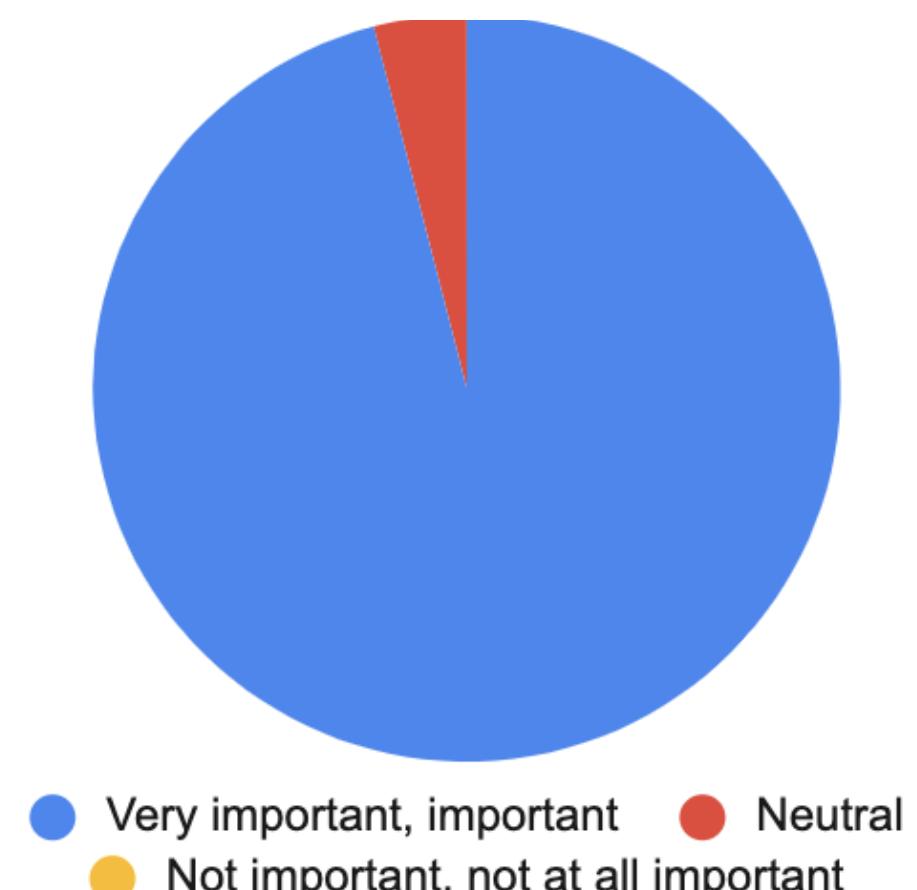
Figure 1

The percentage of blind people surveyed that are concerned with ___ when authenticating themselves in public spaces

Figure 2

1. Faustino, D. (2018). Bend passwords for people with vision impairment.
2. Azenkot, S., Rector, K., Ladner, R., & Wobbrock, J. (2012). PassChords: secure multi-touch authentication for blind people. *ASSETS '12: Proceedings of the 14th international ACM SIGACCESS conference on Computers and accessibility*, 159-166.
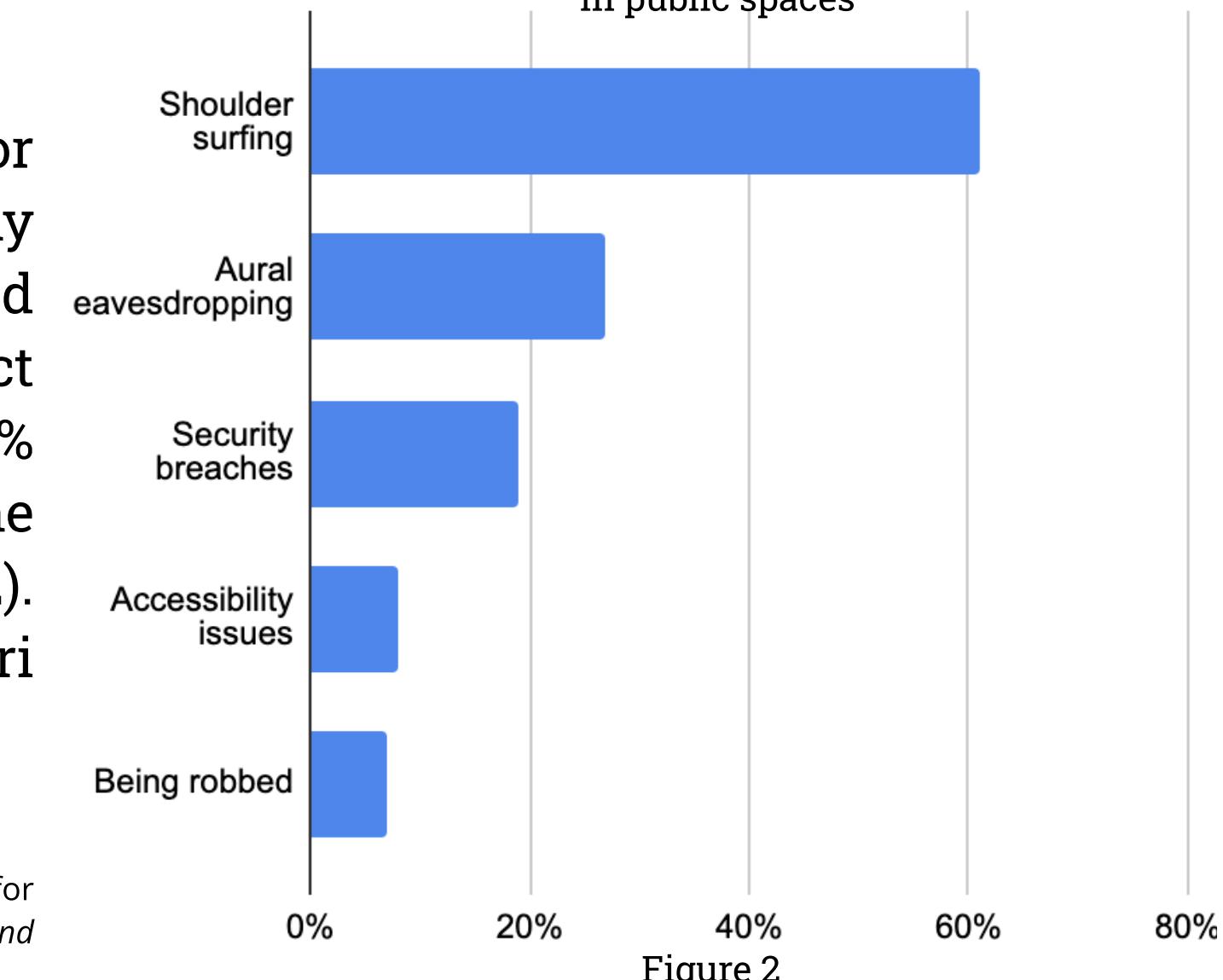
Concept 2
Research through Design

Research questions

1. Can people remember rhythm-based passwords better than text-based passwords?

2. Are rhythm-based paswords more convenient than text-based passwords?

3. Do rhythm-based passwords seem more secure to the users than text-based passwords?
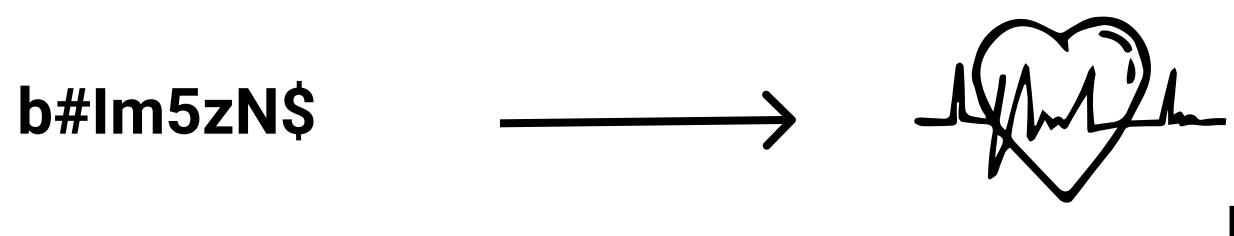
Usability and Security of Rhythm-based Passwords

Why use rhythm based authentication?

Usability
One problem many people have with classic password based digital authentication is remembering the passwords. Especially, since secure passwords should be long, contain numbers and special characters, and should not be reused.

Research shows that music associated to strong positive emotions can be remembered for years [1]. Since music can induce emotions, and emotional stimuli are remembered better than non-emotional ones, rhythm based passwords might be easier to remember.

Security
Rhythm-based authentication could also be more secure than classic passwords due to the following advantages:
 - password entry without exposing the device
 - rhythms are hard to capture
 - nontrivial password imitation
Therefore, aural and visual eavesdropping lead to only 10.7% successful imposter logins [2].

b#lm5zN$ ⟶ [3]

Project plan:
● find comparable text- and rhythm passwords
● user study comparing them based on
　　● ability to memorize
　　● convenience
　　● security
　　　as observed by the participants

1. Eschrich, S., Münte, T.F. & Altenmüller, E.O. (2008) Unforgettable film music: The role of emotion in episodic long-term memory for music. *BMC Neurosci 9.*
2. Wobbrock, Jacob. (2009). TapSongs: Tapping rhythm-based passwords on a single binary sensor. *UIST 2009 - Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology.*
3. Tatyana. *Noun Project.*

Concept 3
Artistry and Craftsmanship

Research questions

1. Can rhythm-based authentication be visualized in a more aesthetically pleasing format than text based passwords?

2. Can visual or auditory feedback be used as tools to make a user's rhythmic password easier to remember?

Visualization of Rhythm-based Passwords

The idea for this concept is to not only construct a functioning rhythmic authenticator but also to include appealing and human friendly visualizations. These visualizations could, for example, include movement, transformation and morphing of elements in the design, a change of colors and themes or even auditory feedback as a result of human interaction.

Research questions
One interesting point is to what extent a clean and visually appealing design in it self can make this method more appealing to users. Another point we would like to research further is whether visual or auditory feedback can be utilized to help users better remember their rhythms.

Existing research
As far as we know, little research exists for this problem specifically, but visualization as an aid to remember has been reseach for a very long time. It is very likely that knowledge from visualization and cognition in general will be useful in developing this concept.

Plan
- research the effect of certain types of visualizations
- develop multiple prototypes
- conduct user studies comparing the prototypes
    - ability to memorize
    - satisfaction of design
    as observed by the participants