

How do background images affect the security of graphical passwords?

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PassTiles

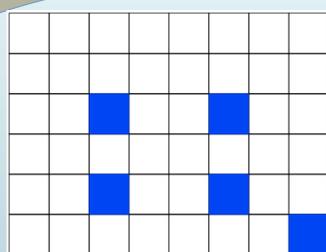
- Password consists of 5 tiles on a 6x8 grid,
- To login, user must click the correct 5 tiles (in any order)
- Theoretical password space is 21 bits



User Study

- 1 week between-subjects study
- each participant had one password with *blank* background, one password with *image* background
- 33 participants (22 female)

PassTiles passwords were memorable for users. Most users did not reset any passwords during the study, and password creation (med=41 seconds) and login times (med=5 seconds) were short.

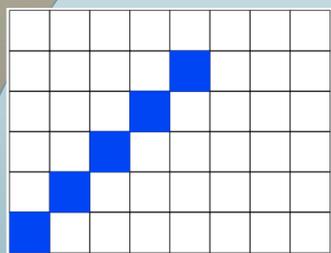


Rectangle:
Pwd space: 14 bits
Seen in 23% of studied passwords

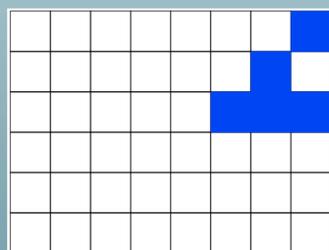
Patterns

Choosing passwords containing patterns limits the possible password space, and increases the vulnerability to dictionary attacks. We identified 5 password patterns, and many passwords contained more than one pattern. We found no significant differences in pattern occurrence for any of the 5 patterns between conditions.

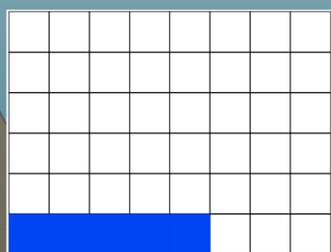
We speculate that these patterns constitute *weak password spaces* [1], since they can be generated, contain an increased likelihood of passwords, and are small enough to be exhaustively searched.



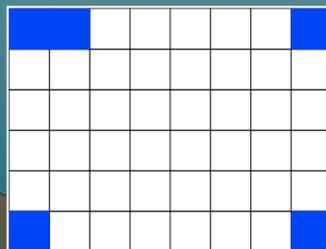
Diagonal:
Pwd space: 5 bits
Seen in 4% of studied passwords



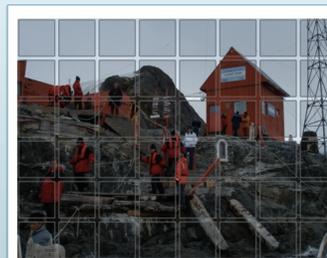
Proximity:
Pwd space: 18 bits
Seen in 49% of studied passwords



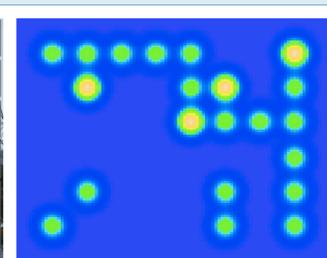
Line:
Pwd space: 9 bits
Seen in 27% of studied passwords



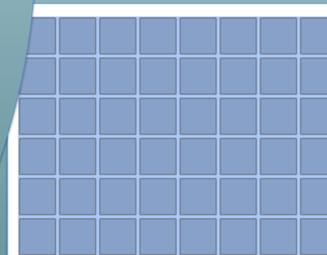
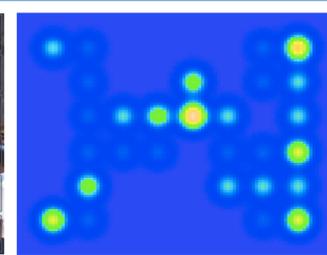
Corner:
Pwd space: 19 bits
Seen in 68% of studied passwords



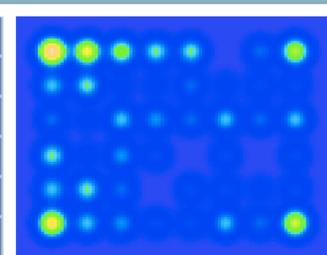
Antarctica (5 passwords)



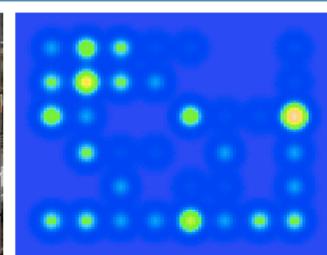
Blankets (12 passwords)



Blank (39 passwords)



Luggage (17 passwords)



Hot-Spots

Hot-spots, or particular grid tiles often chosen as part of passwords, can make passwords more susceptible to attack. On the image backgrounds, tile choices corresponded to particular points in the images. On the blank background, tile choice skewed to the top left.

Conclusion

Our study found no differences in pattern frequency between passwords with image backgrounds and those with blank backgrounds. In both cases, most users chose passwords containing patterns that increased their vulnerability to dictionary attack. User choice seemed to promote memorability, but if it also reduces security, then perhaps other approaches to memorability should be examined.

[1] P. C. van Oorschot and J. Thorpe. On Predictive Models and User-Drawn Graphical Passwords. ACM Transactions on Information and System Security, 10(4), 2008.