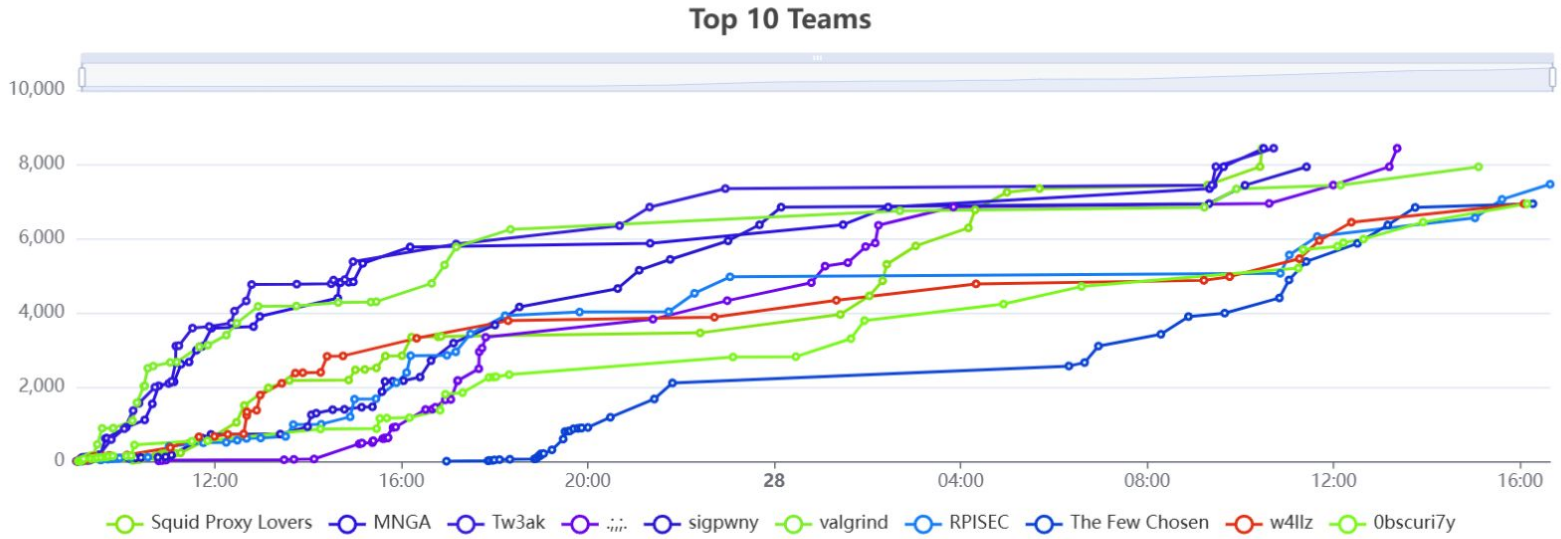
SIGPwny

General FA2025 • 2025-09-28

Physical Security and Lockpicking

Emma and Satvik

Announcements (SunshineCTF)

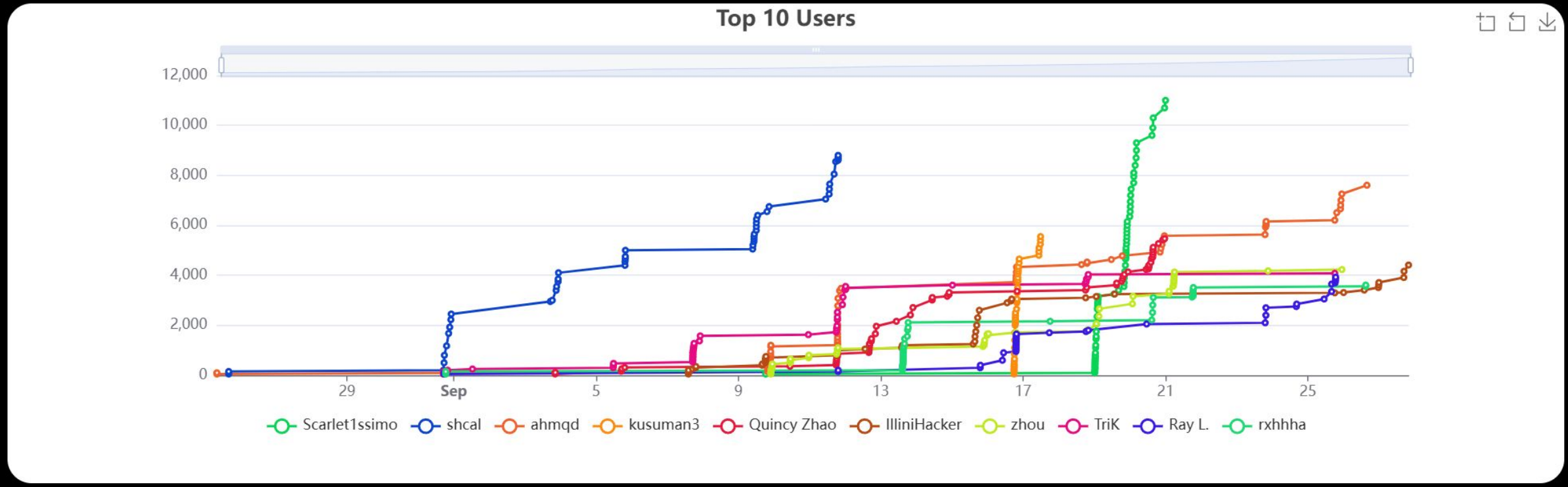


Place	Team	Score
1	Squid Proxy Lovers	8427
2	MNGA	8427
3	Tw3ak	8427
4	.;;;.	8427
5	sigpwny	7927
6	valgrind	7927

Announcements

- CSAW **CTF**
  - We qualified for the CTF finals!
  - We are sending 4 members to NYC to represent SIGPwny and UIUC: Cameron, Ryan, Ahmad, Viraj

- CSAW **Embedded** Security Challenge
  - We had two teams qualify for the final round!
  - Team 1: Minh, Shovan, Krishnan, Cygnus
  - Team 2: Jake, Nikhil, Ryan, Swetha



All | UIUC | Other

Place	User	Score
1	Scarlet1ssimo UIUC	11000
2	shcal UIUC	8800
3	ahmqd UIUC	7605
4	kusuman3 UIUC	5550
5	Quincy Zhao UIUC	5470

Emma Hartman

- SIGPwny admin
- BS-MCS Computer Science
- Learning to crochet and currently procrastinating my OSCP

Satvik Kabbur

- sophomore, joined SIGPwny this semester!
- computer engineering and math ‘28
- fun fact: I’m officially a beekeeper-in-training

ctf.sigpwny.com

sigpwny{you-probably-own-a-ch751-key}

What is Physical Security?

- Deterring threat actors for a physical thing rather than a virtual one
  - Theft/espionage of funds or company secrets, physical harm, etc
  - Very often intersects (IoT/embedded systems, servers)

- Threat models vary widely, what you realistically need is not what a government office needs
  - "Gates, guards, and guns" not the correct answer for everyone

Access Control

- Only allow people you want inside
- Fences, gates, and walls are basic forms of physical access control
- Can get more complicated
  - Keys - suitable for most civilians
  - Keycard entry

Surveillance

- Deters more noticeable forms of entry
  - "Just break a window/door/wall"
  - Lock bypass can be time consuming
- Cameras
  - Vanilla security cameras
  - "Smart" cameras, cloud
- Guards

Can You Spot 5 Barriers to Entry??

Cameras and More Barriers

Security Checks

It's time to pick locks!

But first a disclaimer

"Know Your Rights"

- Different states have different laws on owning lockpicks and physical security tools
- Charges can be made worse if lockpicks are found on you
- https://www.toool.us/lockpicking-laws.php for more details about about U.S. lockpicking law
- We are not lawyers

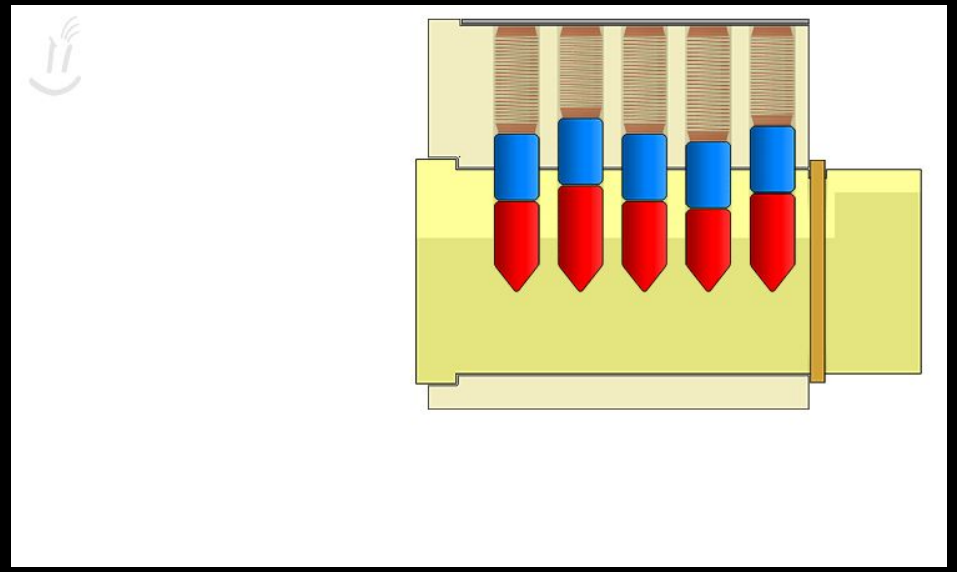
Don't Get Yourself (or Us) In Trouble

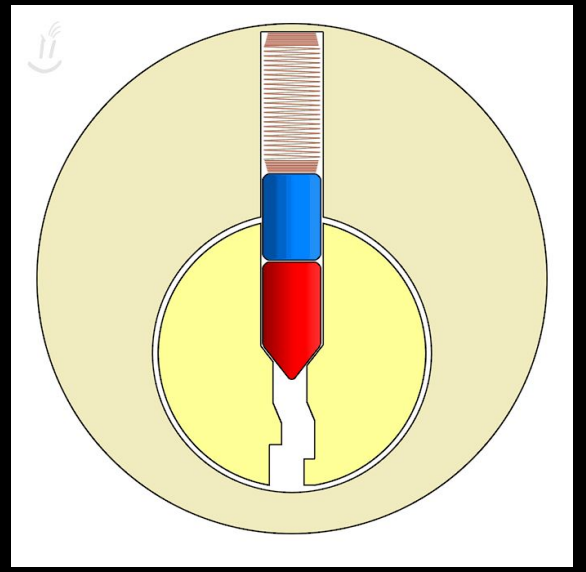
- If a lock is not owned by you, it is probably a felony to pick it
  - University locks
  - Dorm/apartment locks (those spaces are rented!)
  - You have permission to pick our challenge locks today
- Do not pick anything you rely on to work (house locks, personal gym locks, etc)
- Give us back our lockpicks/locks when you're done
  - We will give you a kit, you can share them but please don't mix tools
  - If we don't get all the picks back, we will have to notify building staff and we don't want to have to do that

Now let's pick locks

Pin Tumbler Locks

- When you think of a lock and key, probably this
- Cylinder holds pins that are cut at certain points, set in right place by key
- Tiny imperfections misalign the holes, allowing for lockpicking





Lockpicking

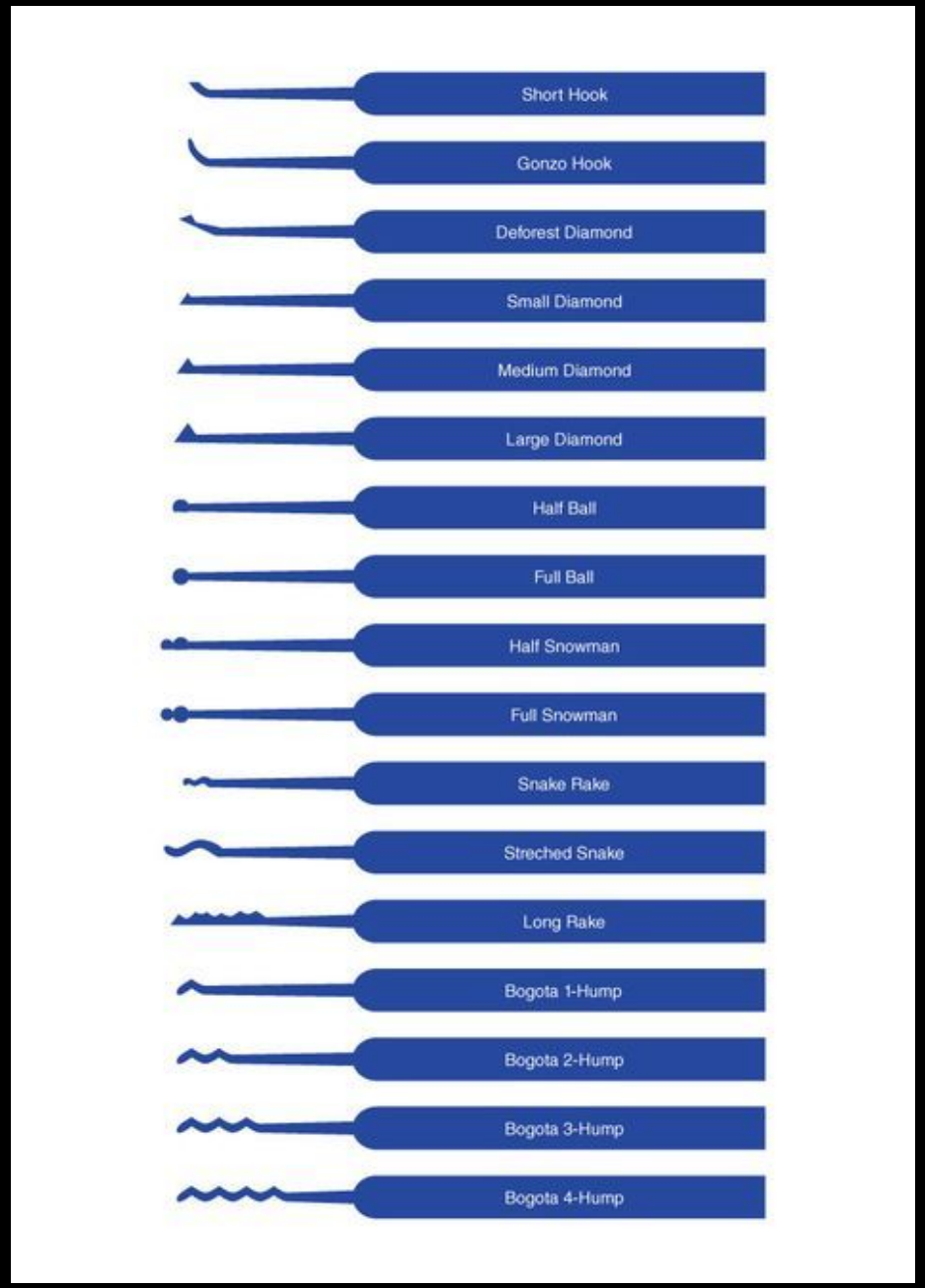
- Goal: perform the roles of the key without having it
  - Physical object performing the turning action
  - Pins in the spot they need to be to turn the lock
- Manufacturing defects allow you to set pins one at a time without always having the key in place
- Method:
  - Provide tension to turn the keyway using tension
  - Set pins in place using a lockpick

Tension

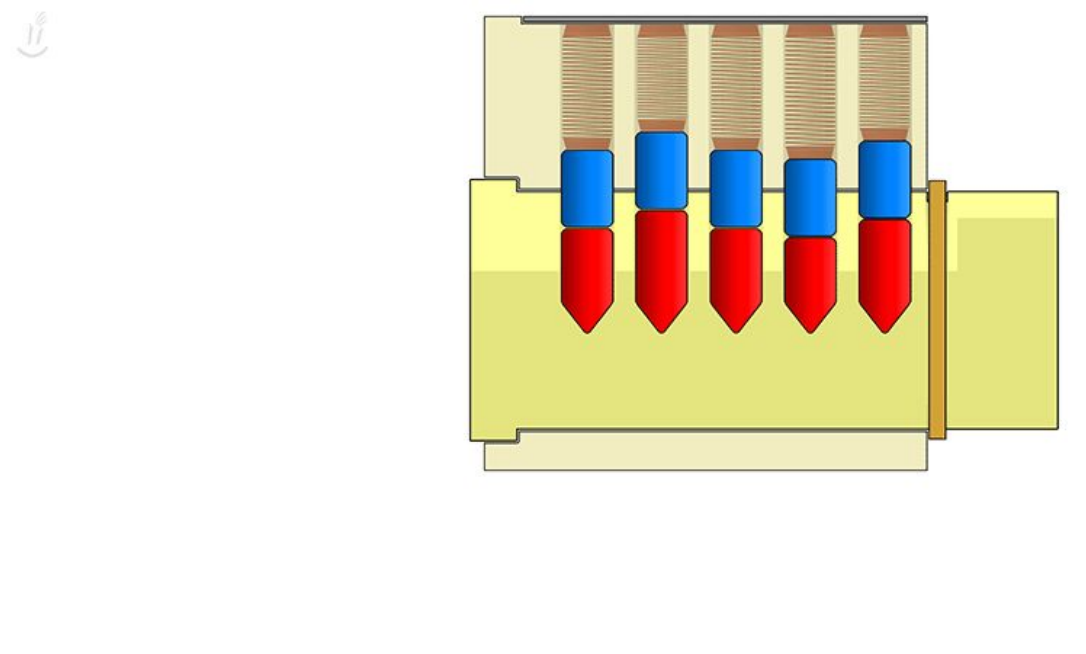
- More important than the picking itself
- Two types: bottom and top of keyway
  - Affect the environment your lockpick sits in and how you receive feedback
- The amount of pressure you give is crucial
  - Too much will make it hard to push the pins, too little will make it hard to receive feedback

Lockpicks

- Single pin
  - Hooks
  - Diamonds
  - Ball/snowmen
- Rakes
  - Long rakes
  - Snakes
  - Bogata



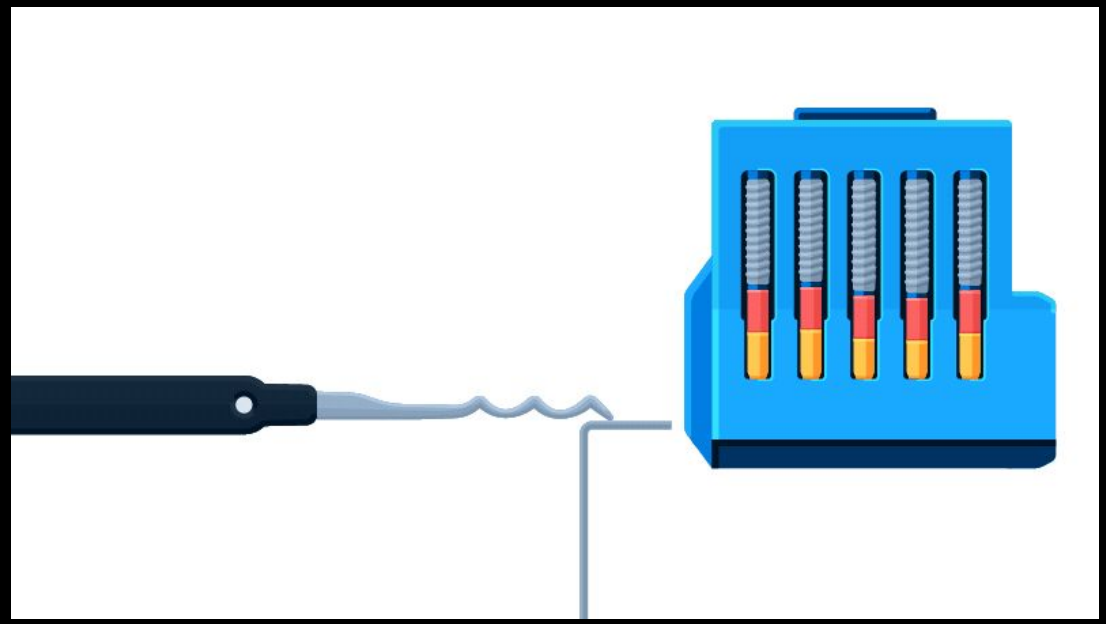
Single Pin Picking



1. Grab a properly sized tensioning tool and a short hook
    a. The crowbar shaped thing and the hook shaped one
2. Put the tensioning tool either at the top or bottom of the keyway and turn
    a. Your picks go at the bottom
    b. Don't push too hard, just hard enough that you'll feel feedback
3. Feel for the pin with the most tension and bring it up until it clicks
4. Continue the process until the lock is picked

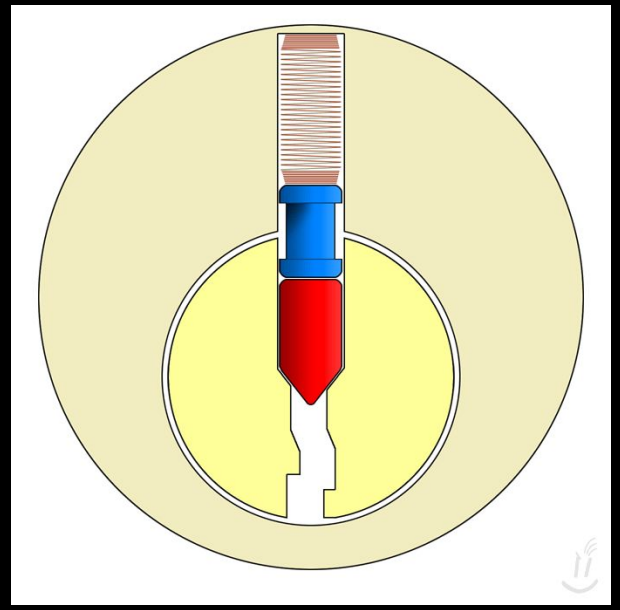
Raking

- The power of probability!
- Gently rock the wavy shaped pick inside the lock until you can turn it open with the tensioning tool
- Very effective with low security locks, becomes less reliable when you face security pins



Security Pins

- Deters low-skilled attacks by making picking harder
- Come in many shapes, all designed to trick you into thinking the lock is partially picked
- Makes lockpicking more fun!

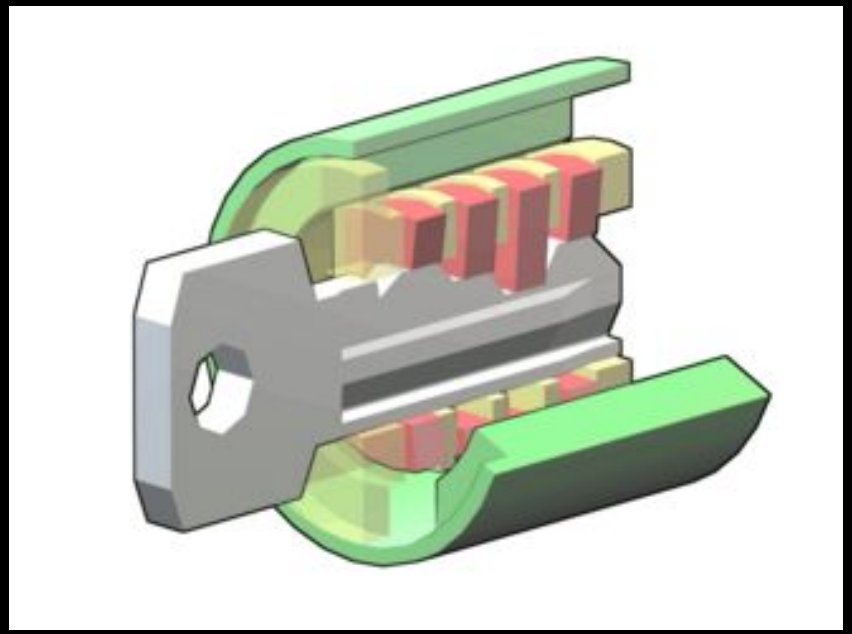


Demo: Raking a Lock

Other Locks

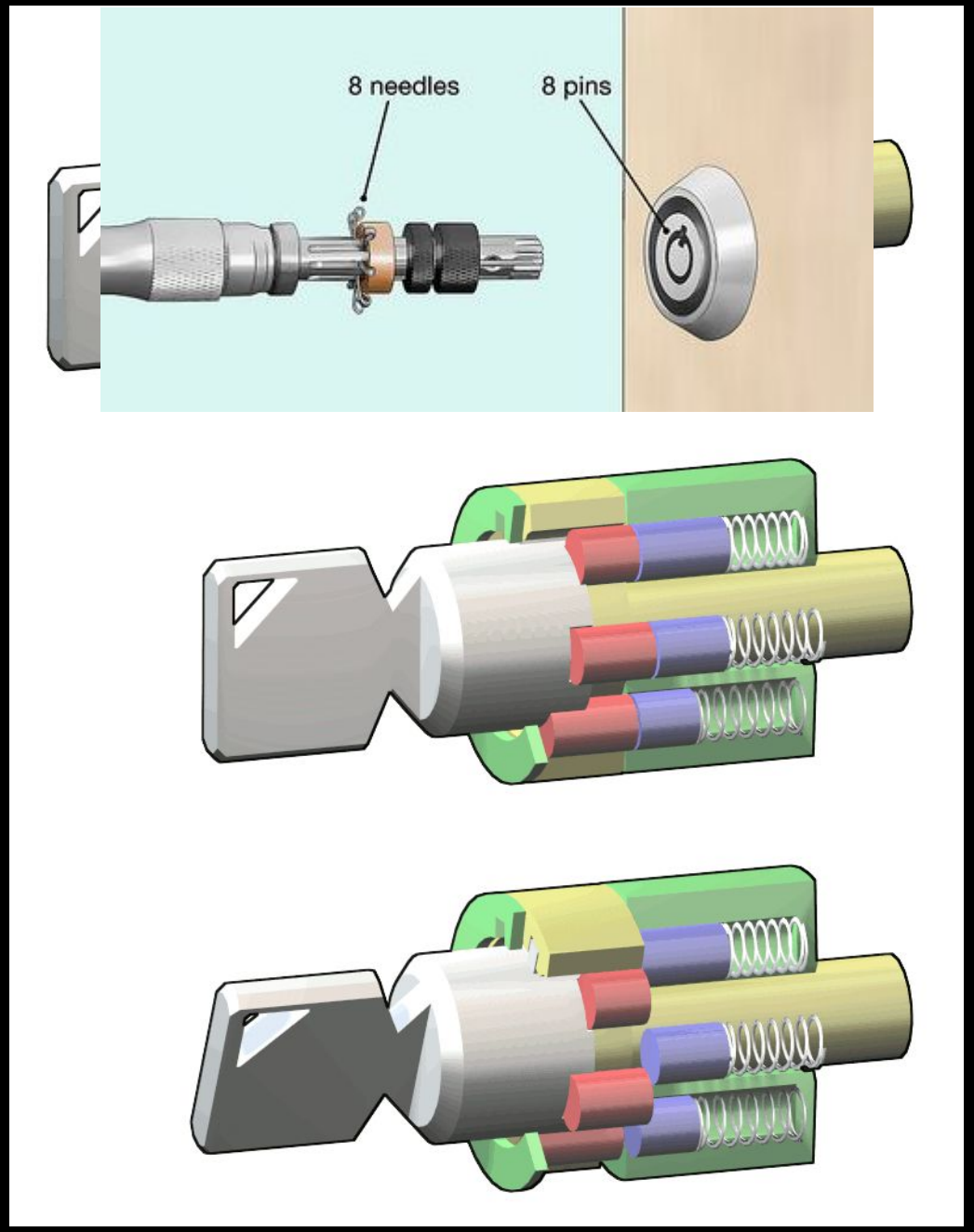
Wafer locks

- Generally pretty poor quality, bad tolerances
- Often bad enough that you can use vaguely key-shaped items called key jigglers



Tubular Locks

- Tubular Locks place the pinstack parallel to the keyway
- Same idea overall, just a circle of pins instead of a line
- You can tension the core and single-pin pick by depressing the pins, but most are also susceptible to impressioning tools



Disk Detainer Locks

- Considered "more secure," Disk Detainer locks are found in high end locks, and most bike locks (Kryptonite, etc.)
- A bar (blue) prevents the core from rotating
- Each disk has a cut at a certain rotation
- Once all disks align, the bar drops and the core rotates
- Pickable with speciality tools:
  - Same principle as tumbler locks, use one disk to tension the core, while manipulating other disks
  - Disks will click into place as you slowly lower the bar
  - A rotating manipulator allows you to rotate disks

Is This Practical?

- Honestly, not really
  - Break open a window
  - Tailgate
  - Find an unlocked door
  - Other bypass methods

Table 7.

Method of entry in household burglary involving unlawful entry, by presence of household member, 2003–2007

Method of entry	Household member not present		Household member present	
	Average annual number	Percent	Average annual number	Percent
Total	1,217,030	100.0 %	623,520	100.0 %
Someone let the offender in	19,960	1.6 %	109,810	17.6 %
Offender pushed way inside	2,750	0.2 ^	73,790	11.8
Open door or window	209,430	17.2	168,560	27.0
Unlocked door or window	481,230	39.5	174,760	28.0
Had key	95,740	7.9	22,490	3.6
Picked lock or window	49,600	4.1	14,020	2.2
Unknown means through locked door or window	64,340	5.3	10,720	1.7
By other means	260,870	21.4	38,890	6.2
Don't know	33,110	2.7	10,480	1.7

Note: Unlawful entry is a completed burglary committed by someone having no legal right to be on the premises even though no force was used to gain entry. An offender may gain access to a residence when household members are not present by being let in by an individual not living in the household, such as a visiting guest, housekeeper, or repair person. Totals may not add to 100% due to rounding.
^Based on 10 or fewer sample cases.

Bypass Crash Course

Non-pick tools that still get locks open

Common Keys

What Does This Open? (GAME)

What Does This Open? (GAME)

Ford Crown Victoria (older police cars, taxis)

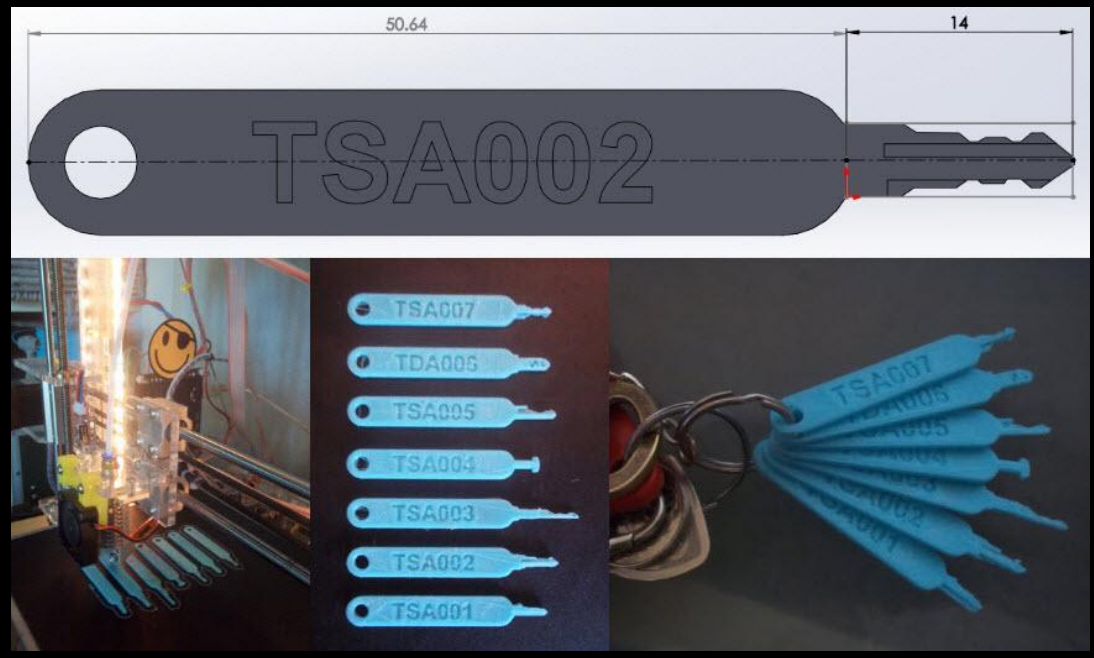
Golf carts

Elevator fire service

Tractors

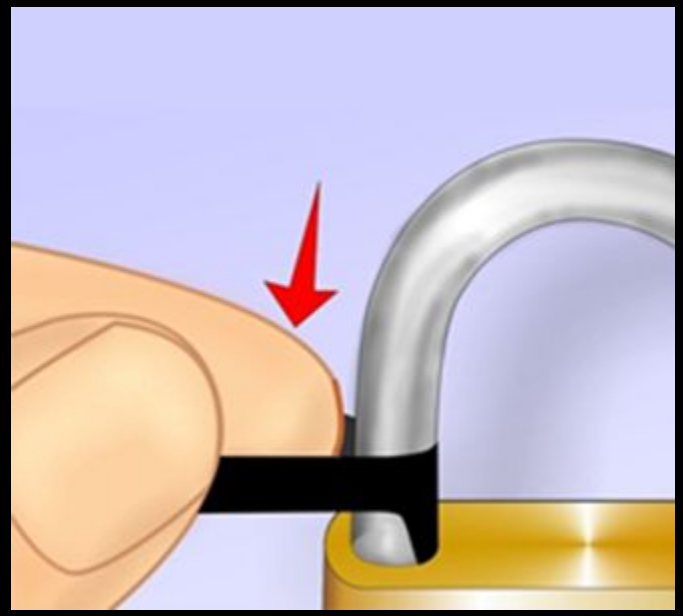
Uh Oh


TSA007
TSA006
TSA005
TSA003
TSA002
TSA001


50.64
14
TSA002
TSA007
TDA006
TSA005
TSA004
TSA003
TSA002
TSA001

Shimming

- Unprotected lock shackles
- Separate latch from shackle, open without touching the cylinder at all
- Works well on cheap padlocks, not so much on higher grade

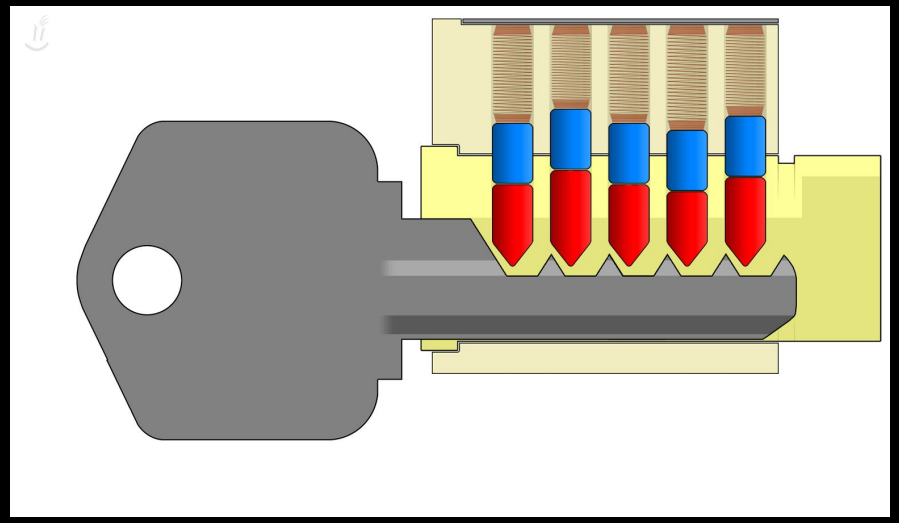


Knife Bypass

- Use a thin implement to directly manipulate locking mechanism
- Depends on the specific type of lock

Bump Keys

- Bounce all the top pins above the shear line at the same time
- Turn the bump key
- Must correspond to the specific lock
- **Illegal in Illinois, do not buy!**



Go pick locks!!!

- Clear lock
  - What's happening inside the lock when you feel feedback?
- Progressive locks (2, 3, 4, or 5 pin)
  - Work your way up towards 4 and 5 pin locks
- Master Lock No 3 (blue)
  - Your first real-world lock!
- Master Lock 140 (gold)
  - Your first security pin!
- Brinks Lock
  - More security pins
- Door Locks
  - How secure is your door? Spoiler: not very!
- Safes (ask us to pull out if you want to try!
  - Try your hand at tubular locks and safe cracking

Next Meetings

2025-10-02 • **This Thursday**

- Reverse Engineering
- Learn how to reverse engineer interpreted programs

2025-10-05 • **Next Sunday**

- x86-64 Assembly
- Learn the fundamentals of x86-64 assembly including the stack, memory, registers, instructions, and syscalls.

ctf.sigpwny.com

sigpwny{you-probably-own-a-ch751-key}

Meeting content can be found at sigpwny.com/meetings.

SIGPwny