

**Use behavioral
biometric analytics to
stop student cheating.**



WEBINAR SERIES

Use behavioral biometric analytics to stop student cheating.

Deterrence and enforcement.

19APR2023 / Nelson Santini



**Biometric
Signature
ID**

BSI is EDU and more...



2007

EST

240

Customers

2

Patents

44

Claims



10M+

Remote
Assessments

2.5M+

Courses
Managed

100M+

Identity
Validations

1M+

Active
Candidates

Behavioral biometrics cybersecurity hardened software & proctoring solutions for academia.

Agenda



- Forms of cheating
- Cheating and its impact on academia
- How does cheating flourish?
- Regulations and institution liability
- Deterrence and enforcement
- Attribution & behavioral biometrics
- Analytics
- The “find out” phase

Forms of cheating



Fraud

Financial Student
Aid

Impersonators

Online Paid
Proxies

What is the magnitude of the problem?



Financial aid fraud



Financial aid fraud is material



“It’s all about the money”



**\$120 Billion
Dollars**

Appropriated Budget

**18 Million
Students**

Apply Yearly

Fraud

Financial aid fraud is material



“It’s all about the money”



**\$6 Billion
Dollars**
STOLEN Yearly

Fraud

Financial aid fraud is material



“It’s all about the money”



**\$6 Billion
Dollars**

STOLEN Yearly

**Community
Colleges**

Fraud

Impersonators



Impersonators are a business



“It’s all about the money”



\$Multi-Billion

Global Industry

Cheating

Impersonators are a business



“It’s all about the money”

**THE
WALL STREET
JOURNAL**

\$Multi-Billion

Global Industry

Cheating

Impersonators are a business



“It’s all about the money”



\$Multi-Billion

Global Industry

Cheating

And the volume



The background is a dark blue gradient with a complex, abstract pattern. It features a grid of small, light blue dots connected by thin lines, creating a mesh-like structure. Overlaid on this are several large, wavy, glowing blue lines that sweep across the frame, giving it a sense of motion and depth. The overall aesthetic is futuristic and digital.

**31M students
cheating globally**

The background is a dark blue gradient with a complex, abstract pattern. It features a grid of small, light blue dots connected by thin lines, creating a mesh-like structure. Overlaid on this are several large, wavy, glowing blue lines that sweep across the frame, giving it a sense of motion and depth. The overall aesthetic is futuristic and digital.

**3.2M students
cheating in the U.S.**

What does this mean?



TAG - You are “it”

If you can't recognize the “mark” at the table...

Cheating

Impact of cheating



Beyond the financial impact on society, academic cheating compromises the brand of the institution, erodes trust on degrees conferred, and in the worst cases allows unqualified graduates to discharge their duties at the expense of public safety.

**STOP
CHEATING!**

How does cheating flourish?

- **Weak “Identity” regulations**
- **Dark web resources**
- **YouTube tutorials**
- **Lone actors**
- **Organized crime**
- **AI/ML Crime - BOTS**



Critical regulations to observe...



34 CFR §602.17(g)(h)

**Real
Students**

**Correct
Students**

Deterrence and enforcement



Stopping cheating



- Deterrence
 - “The juice is not worth the squeeze”
- Enforcement
 - “You broke it; you bought it”
- **1:1 Unbreakable identity attribution**
- **Persistent course validation**
- **ML real-time behavioral analytics**
- **Forensic global analytics**
- **Revised regulations & enforcement**
- **Enforceable code of ethics**

Stopping cheating



ATTRIBUTION

To stop cheating we must have strong attribution of action, so that regulations can be proactively and retroactively enforced.

The former prevents the infraction, the latter deters the intent to cheat.

“Creating” attribution



- You MUST have a 1:1 unbreakable bond between the digital data (avatar) and the real human.
- You must validate the bond between avatar and human frequently and persistently when testing or educating online.

The “coolest” analytics are unenforceable unless you have unbreakable attribution.

Behavioral biometric credentials give you this 1:1 bond.

34 CFR §602.17(g)(h)

Behavioral analytics

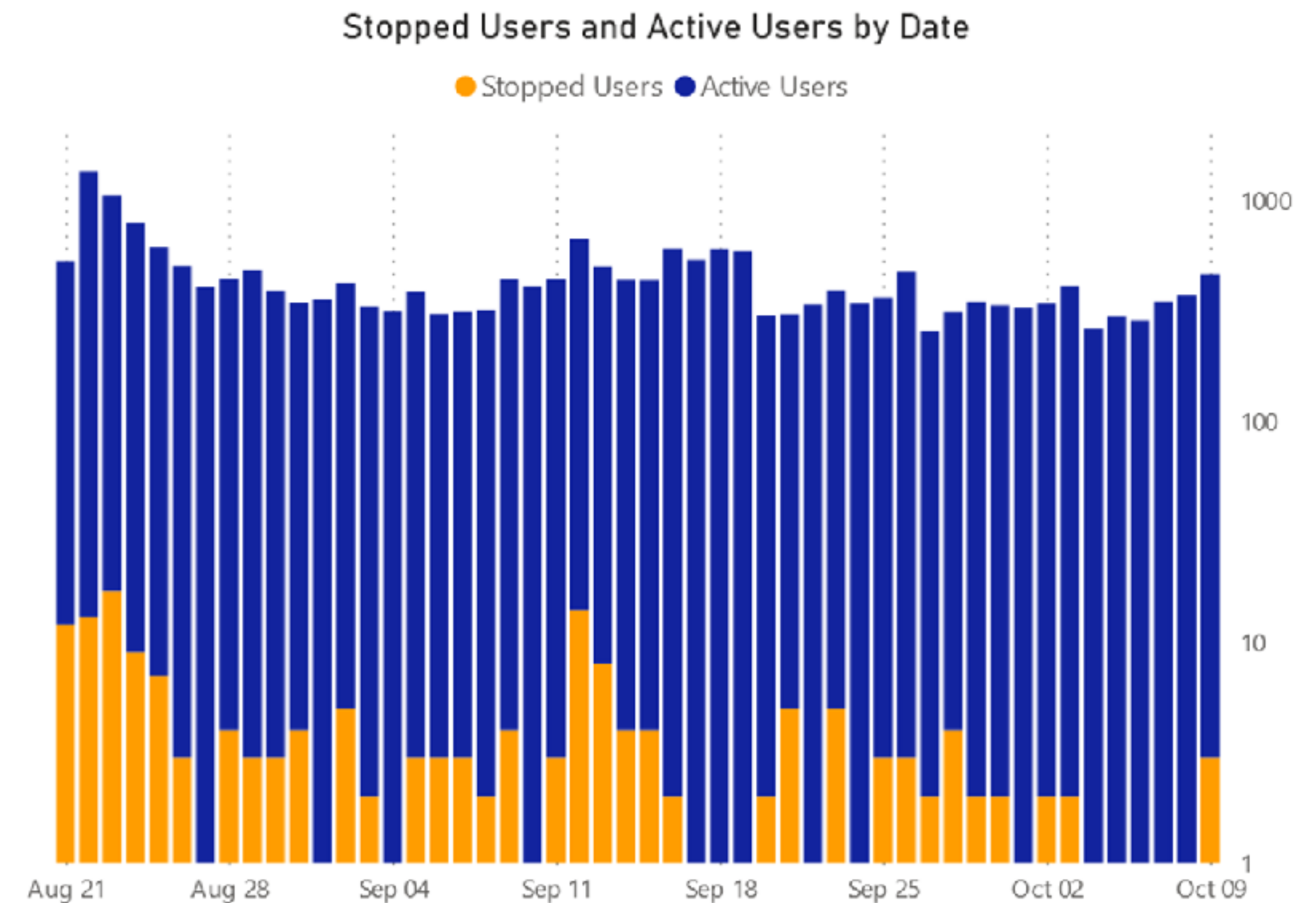


Stopping BOTS



- Examples
 - Fake students enrolling for class
 - Fake financial aid claims
- Tells
 - Bursty behavior
 - Synchronized behavior
 - “Flash” agility and speed
 - Persistent behavior from multiple locations

TimeStamp	TimeSincePriorRow	ActionID	DisplayName	SessionID
2022-10-15 15:55:37.627		23	Launch	gvnw413tdcsuzxhpqlggs5m2
2022-10-15 15:57:02.090	000 d 00:01:24	6	Create Profile	gvnw413tdcsuzxhpqlggs5m2



Stopping BOTS - 2



- Examples
 - Fake students enrolling for class
 - Fake financial aid claims
- Tells
 - Bursty behavior
 - Synchronized behavior
 - “Flash” agility and speed
 - Persistent behavior from multiple locations

	Id	Time Stamp	UserId	SessionID	Severity	Name	Subject
1	1	2018-11-13 20:29:39.140	268511	vw5hkea2tzkn3icchnwlefbcb	0	detectRobot	RTEN: r
2	2	2018-11-13 20:32:36.467	407004	Qjfm2xpoxum3az5hbmfi5zap	0	detectRobot	RTEN: r
3	3	2018-11-13 20:35:06.627	393588	kboxqpsidpyqhv5y5qenanhf	0	detectRobot	RTEN: r
4	4	2018-11-13 20:50:04.637	411803	1ur3w1h4ttlqnzn1clmpw34	99	detectRobot	RTEN: r
5	5	2018-11-13 20:51:17.733	249310	g2juu1ykgqhqnfnq0zrztbki	99	detectRobot	RTEN: r
6	6	2018-11-13 21:10:11.340	273546	frcia1pqs0hgjzxsosjtbsbs	99	detectRobot	RTEN: r
7	7	2018-11-13 21:17:03.600	219933	1fnd02dvz1v5dves5xkg5g4y	99	detectRobot	RTEN: r
8	8	2018-11-13 21:32:47.653	250106	wkvcnbocbimo1ylbwl01py	99	detectRobot	RTEN: r
9	9	2018-11-13 21:52:14.917	290143	ykoY4coudih5xtyljqdqka2i	99	detectRobot	RTEN: r
10	10	2018-11-13 21:57:09.757	411925	0is04ewsi3ndz14slgztqiql	99	detectRobot	RTEN: r
11	11	2018-11-13 22:09:31.980	275190	2w03c0b4enzw3jd3bnncx2u	99	detectRobot	RTEN: r
12	12	2018-11-13 22:33:26.207	407402	aldaryopbn5cxi2fpgtfmv	99	detectRobot	RTEN: r
13	13	2018-11-13 22:33:55.507	261125	2rl1sc3ithnuffxfhyevfz kf	99	detectRobot	RTEN: r
14	14	2018-11-13 23:06:34.297	409127	zw01y2izyc05mpa3vn4uidh4	99	detectRobot	RTEN: r
15	15	2018-11-13 23:56:10.353	273722	ltiywacytd0xgvlfivewtlc	99	detectRobot	RTEN: r
16	16	2018-11-13 23:57:44.570	271029	am1dbnzhrv3ybrvhigo5a5fj	99	detectRobot	RTEN: r
17	17	2018-11-14 00:01:57.980	389184	w1swrq1z5nzhrtagpaj0hmeo	99	detectRobot	RTEN: r
18	18	2018-11-14 00:14:09.813	410316	1bnlfe4nsudgkw10l0eexlzd	99	detectRobot	RTEN: r
19	19	2018-11-14 00:25:57.130	249545	fwc3jlonmznbgw0fvuffis	99	detectRobot	RTEN: r
20	20	2018-11-14 01:01:15.943	409042	5j1o03ujpwhxkjhhambtbnkq	99	detectRobot	RTEN: r
21	21	2018-11-14 01:53:16.410	412034	ul2bjzy2vcg0xdw5c5qmsbz	99	detectRobot	RTEN: r
22	22	2018-11-14 01:57:29.003	239667	jd0rdsss0otrgc51w0y3ofmj	99	detectRobot	RTEN: r
23	23	2018-11-14 01:59:47.883	234394	23xlwxcszkcg0q1pf544knar	99	detectRobot	RTEN: r

Deterrence
Enforcement

Stopping “lawyers”



- Examples
 - “I can’t log in...”
 - “My [tech] doesn’t let me...”
 - “I have an excuse”
- Tells
 - Incomplete sessions - no tries
 - Only one profile attempt
 - Look for accommodation w/o trying

TimeStamp	TimeSincePriorRow	ActionID	DisplayName	SessionID
2022-08-13 20:38:43.603		23	Launch	ykmitrjoqc21tmmjsmarh0ph
2022-08-13 20:38:59.160	000 d 00:00:16	7	Validate Profile	ykmitrjoqc21tmmjsmarh0ph
2022-08-13 20:39:03.563	000 d 00:00:04	7	Validate Profile	ykmitrjoqc21tmmjsmarh0ph
2022-08-18 17:42:03.697	005 d 21:03:00	23	Launch	q5rqcswnydltiukuqjfnqh
2022-08-18 17:42:15.653	000 d 00:00:12	7	Validate Profile	q5rqcswnydltiukuqjfnqh
2022-08-18 17:42:19.847	000 d 00:00:04	7	Validate Profile	q5rqcswnydltiukuqjfnqh
2022-08-22 01:27:43.540	004 d 07:45:24	23	Launch	ec4npr1dxad2nkd0ezkzbxiu
2022-08-22 01:27:57.443	000 d 00:00:14	7	Validate Profile	ec4npr1dxad2nkd0ezkzbxiu
2022-09-04 13:58:16.253	013 d 12:30:19	23	Launch	cpbehypojjh3aud3jebdonv
2022-09-04 13:58:23.110	000 d 00:00:07	7	Validate Profile	cpbehypojjh3aud3jebdonv
2022-09-05 03:38:09.977	001 d 13:39:47	23	Launch	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:20.510	000 d 00:00:11	7	Validate Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:24.303	000 d 00:00:04	7	Validate Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:36.287	000 d 00:00:12	7	Validate Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:43.227	000 d 00:00:07	8	Lock Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:52.157	000 d 00:00:09	6	Create Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:55.950	000 d 00:00:04	6	Create Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:38:59.343	000 d 00:00:03	6	Create Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:39:03.243	000 d 00:00:04	6	Create Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-05 03:39:07.093	000 d 00:00:04	7	Validate Profile	ymwvjqoex14epp3btdgnqwdy
2022-09-12 22:32:41.543	007 d 18:53:34	23	Launch	xjk0pdw1wc3l4boswvanhpu2

Deterrence
Enforcement

Impersonators - Lone wolfs

- Examples
 - Relative / sibling / friend
- Tells
 - Know ID and password but:
 - Visually different
 - Different IP address
 - Log in at a-typical times
 - Resets the passwords back and forth
 - A to B
 - B back to A

User Name	Time	Signature Data	#	Client IP	Device	Context Action	Partner Account	Succ	Acc.	App	OS / Browser
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 3:08:55 AM	2 2 2 2	4	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✓	56	Biosig-ID	Windows 10 Chrome 58.0.3029
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 3:35:38 AM	2 2 2 2	4	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✓	70	Biosig-ID	Windows 10 Chrome 58.0.3029
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 4:00:20 AM	2 2 2 2	4	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✓	79	Biosig-ID	Windows 10 Chrome 58.0.3029
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 4:48:19 AM	2 2 2 2	5	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✗	0	Biosig-ID	Windows 10 Chrome 58.0.3029
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 4:48:36 AM	2 2 2 2	5	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✗	0	Biosig-ID	Windows 10 Chrome 58.0.3029
MATH 1828 College Alegbra Summer 2017 B1 33802 Sta	6/14/2017 4:48:53 AM	2 2 2 2	4	103.255.6.94 Islamabad, Islamabad Capital Territory, Pakistan	Mouse	Validate/Validate Profile	Canvas LTI	✓	77	Biosig-ID	Windows 10 Chrome 58.0.3029

Examples of “users” entering the password in the incorrect sequence

Impersonators - Lone wolfs - 2



- Examples
 - Relative / sibling / friend
- Tells
 - Know ID and password but:
 - Visually different
 - Different IP address
 - Log in at a-typical times
 - Resets the passwords back and forth
 - A to B
 - B back to A

	TimeStamp	TimeSincePriorRow	ActionID	DisplayName	SessionID	SameSessionID	ClientIP	AttemptSuccess
1	2022-08-02 20:56:40.690		23	Launch	vg2fplosoxccms1tky2agvnk	New Session	52.35.50.128	
2	2022-08-02 20:56:52.513	000 d 00:00:12	7	Validate Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Fail
3	2022-08-02 20:57:11.980	000 d 00:00:19	7	Validate Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Fail
4	2022-08-02 20:57:54.390	000 d 00:00:42	7	Validate Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Fail
5	2022-08-02 20:57:55.437	000 d 00:00:01	24	Send Authentication Mail	vg2fplosoxccms1tky2agvnk		52.35.50.128	
6	2022-08-02 20:58:16.440	000 d 00:00:21	25	Verify Auth. Mail	vg2fplosoxccms1tky2agvnk		52.35.50.128	
7	2022-08-02 20:58:26.680	000 d 00:00:10	25	Verify Auth. Mail	vg2fplosoxccms1tky2agvnk		52.35.50.128	
8	2022-08-02 20:58:26.710	000 d 00:00:00	8	Lock Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	
9	2022-08-02 20:58:47.793	000 d 00:00:21	6	Create Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Success
10	2022-08-02 20:58:55.493	000 d 00:00:08	6	Create Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Success
11	2022-08-02 20:59:04.310	000 d 00:00:09	6	Create Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Success
12	2022-08-02 20:59:15.320	000 d 00:00:11	7	Validate Profile	vg2fplosoxccms1tky2agvnk		52.35.50.128	Success

Deterrence
Enforcement

Impersonators - Cheater farms



- Examples
 - Website / Job board posted
- Tells
 - Single IP address linked to several reset IDs
 - Multiple IP addresses linked to a block of IDs or a single exam
 - Recurrent non-sensical locations on courses over a period of time
 - Recurrent courses / professors linked to non-sensical locations and blocks of IDs

1	12.237.35.130	126
2	50.202.0.114	92
3	50.204.218.50	56
4	153.48.247.250	48
5	38.142.146.114	48
6	50.227.217.134	44
7	50.243.252.41	28
8	12.227.168.131	23
9	67.79.90.2	20
10	96.87.162.249	19
11	50.235.118.90	18
12	198.97.37.85	17
13	204.155.95.87	16
14	207.181.32.3	16
15	198.97.37.83	14
16	207.181.32.4	14
17	75.147.209.37	14
18	198.97.37.93	14
19	204.155.95.83	13
20	204.155.95.89	12

It is not uncommon for an IP address to be used multiple times by the same user.

It is absolutely uncommon to have dozens and hundreds of attempts from different users or different MAC addresses from the same course, exam....

Impersonators - Family members



- Examples
 - Twins / similar looking siblings
 - Parents or close relatives
- Tells
 - Same IP address and course progress at odd times.
 - Concurrent sessions from geographically different locations and / or IP addresses.

1	12.237.35.130	126
2	50.202.0.114	92
3	50.204.218.50	56
4	153.48.247.250	48
5	38.142.146.114	48
6	50.227.217.134	44
7	50.243.252.41	28
8	12.227.168.131	23
9	67.79.90.2	20
10	96.87.162.249	19
11	50.235.118.90	18
12	198.97.37.85	17
13	204.155.95.87	16
14	207.181.32.3	16
15	198.97.37.83	14
16	207.181.32.4	14
17	75.147.209.37	14
18	198.97.37.93	14
19	204.155.95.83	13
20	204.155.95.89	12

It is not uncommon for an IP address to be used multiple times by the same user.

It is physically impossible to be in two places at the same time OR to “stargate” from one end of the world to the other in seconds...

It is also highly suspect to be taking courses and exams “around the clock”

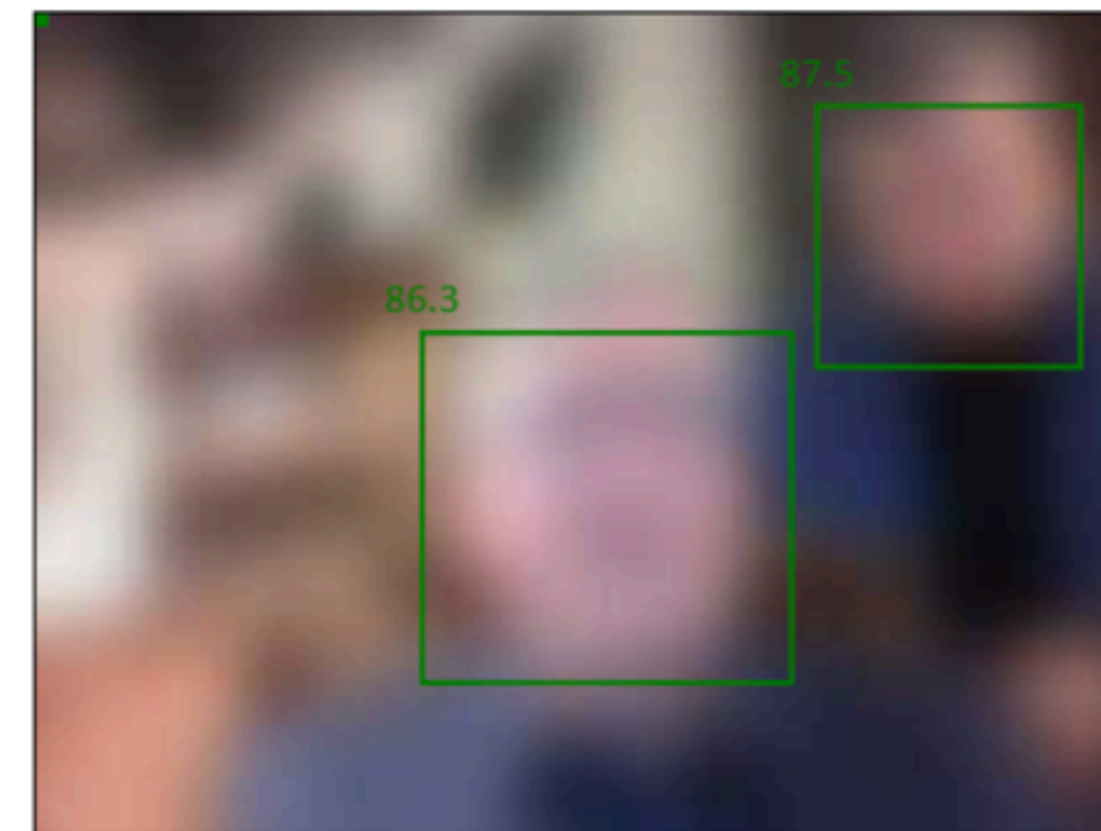
Impersonators - Family members - 2



- Examples
 - Student grows second head
 - Speaking like a ventriloquist
- Tells
 - Visual cues of multiple people in room.
 - Drifting eyes to non-sensical locale
 - Registrable audio w/o lip motion

04/06/2023 12:36 PM
Chuck Rider
chuck.rider@biosig-id.com
[vp4bd3tk55qy1pak11ahusar](#)
Chrome 111.0.0 / Windows 10

Canvas LTI Demo
d2: BioSig-ID Demo (Sales)
d3: Final Exam: Sample quiz
d4: BioSig-ID.Demo
d5: 367



In Grace period



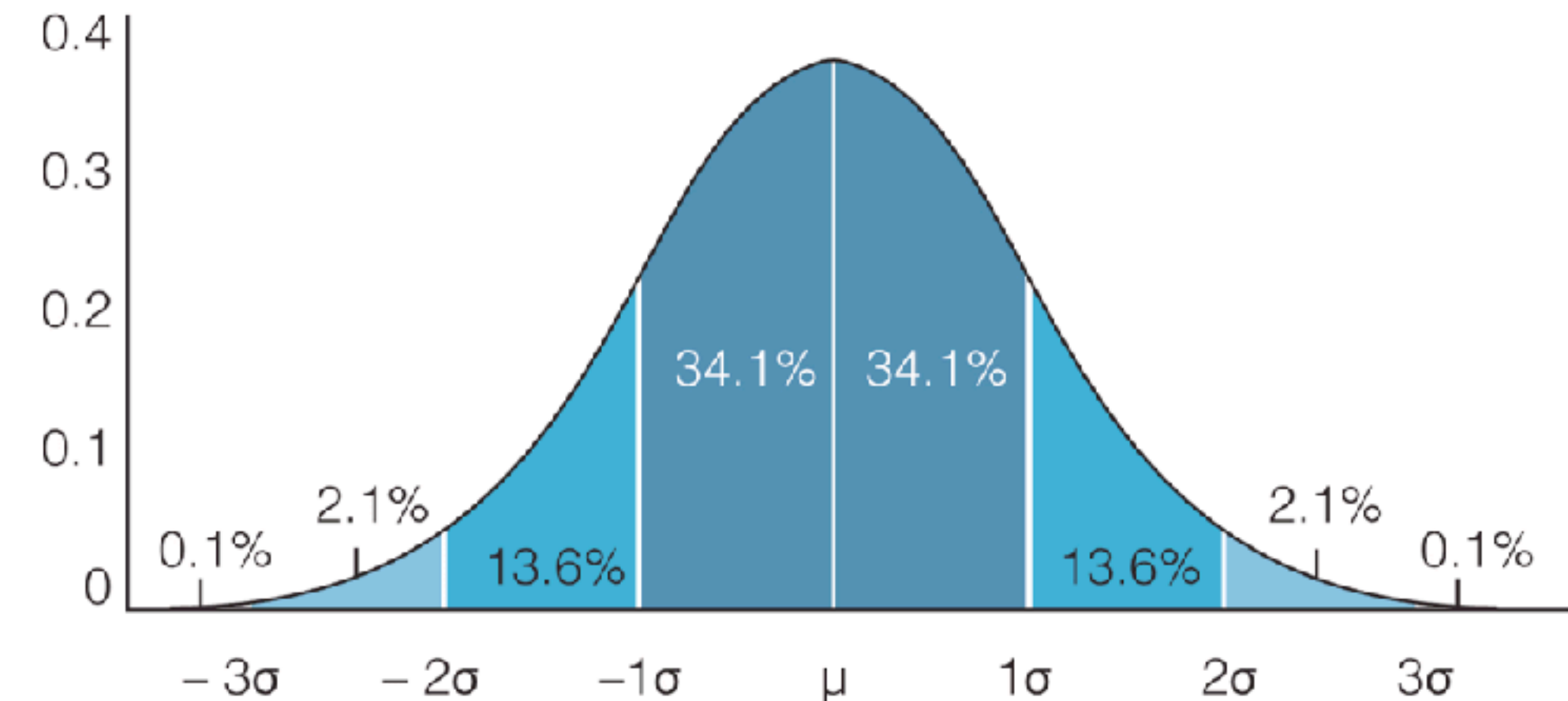
veterrence
Enforcement

Impersonators - Chat GPT / Web



- Examples
 - Extremely fast exam sessions
 - Near perfection
- Tells
 - 2+/3+ sigma delta from established exam normal
 - Acoustics
 - Motion analysis

Distribution of Variance



μ = Expected Value

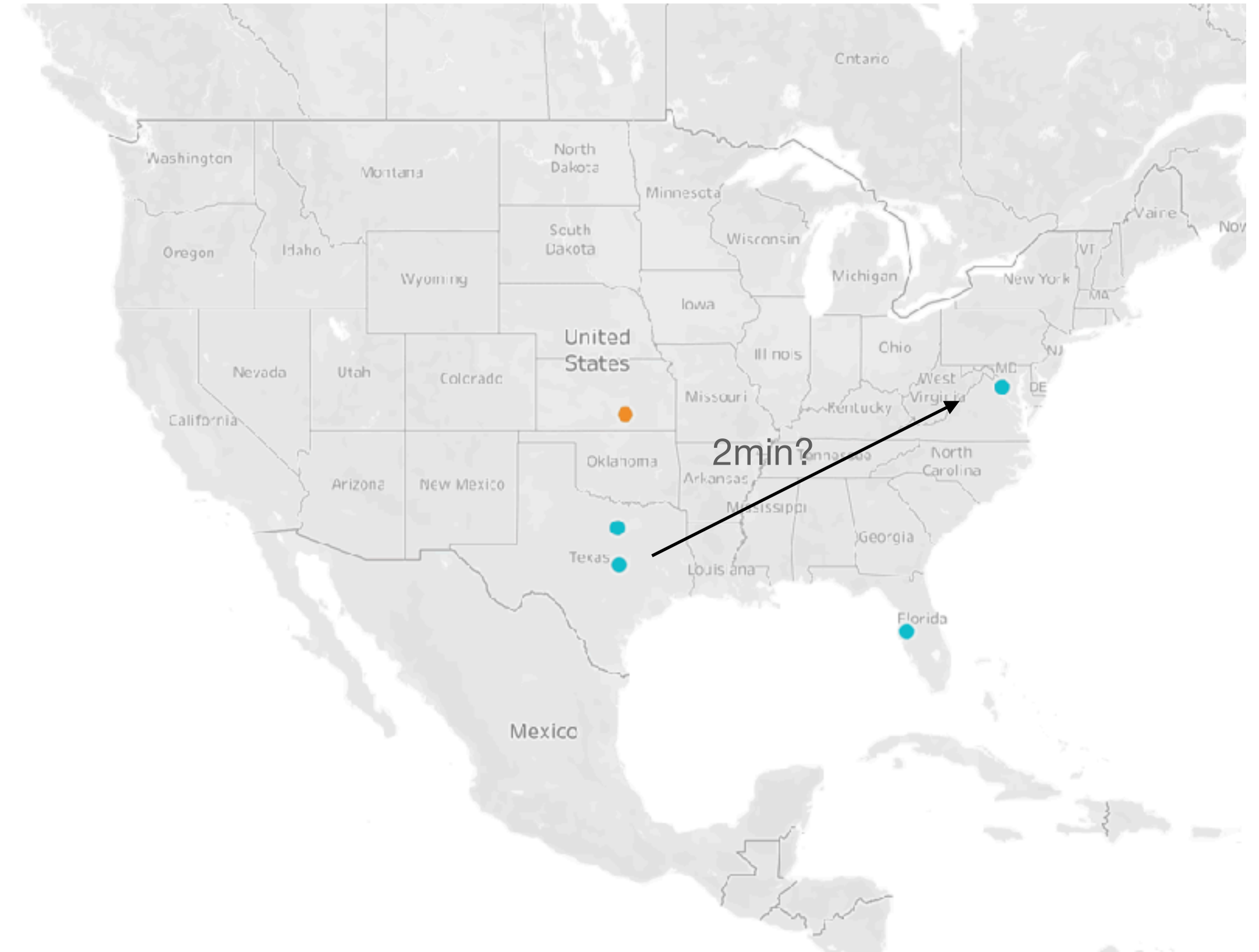
- 1σ to 1σ = 1 Standard Deviation (ie: ~2/3 of the time, your results/variance will fall within this range)
- 2σ to 2σ = 2 Standard Deviations (ie: 95% of the time, your results/variance will fall within this range)
- 3σ to 3σ = 3 Standard Deviations (ie: 99.7 of the time, your results/variance will fall within this range)

Deterrence
Enforcement

Impersonators - “Stargaters”



- Examples
 - Non-sensical geolocations
- Tells
 - Able to travel large distances in short time spans.
 - Able to be in different countries at the same time.

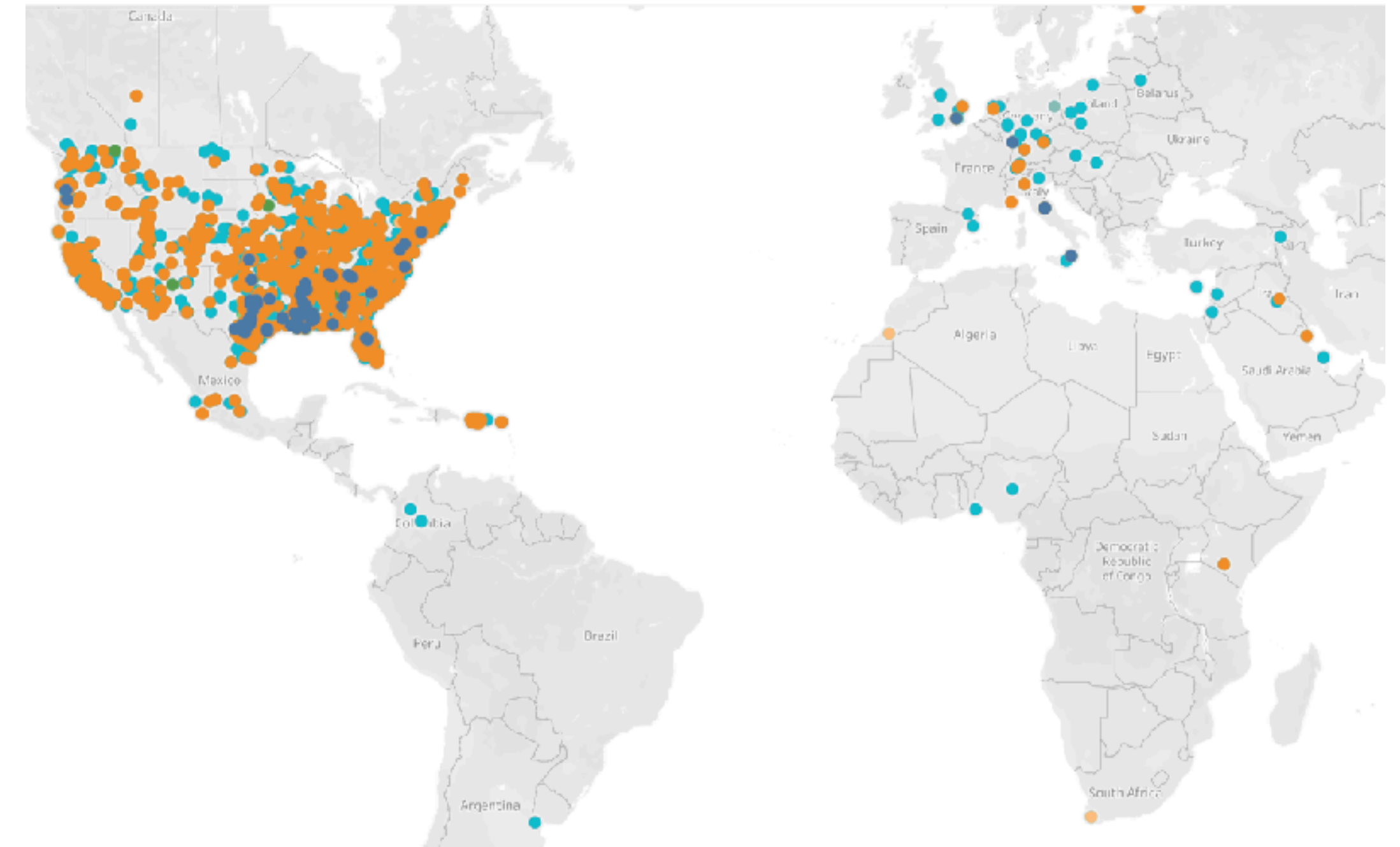


Deterrence
Enforcement

Impersonators - “The wanderers”



- Examples
 - “World traveler” student
 - “Starbucks” jockeys
- Tells
 - Favorite locations outside home or school
 - Overlap with geolocation time stamps of other students in course



Deterrence
Enforcement

“...and find out.” phase



Enforcing supported facts



- Have a clearly stated policy that you sign frequently; perhaps every exam.
- Link the signature to the user via behavioral biometrics
- Collect the data over time.
- Take action - other students know. If you don't take action, your investment is lost.

The “coolest” analytics are worthless unless you have actionable facts.

Behavioral biometric credentials give you this 1:1 bond.

Next...



Advanced MFA



BSI's Behavioral Biometrics

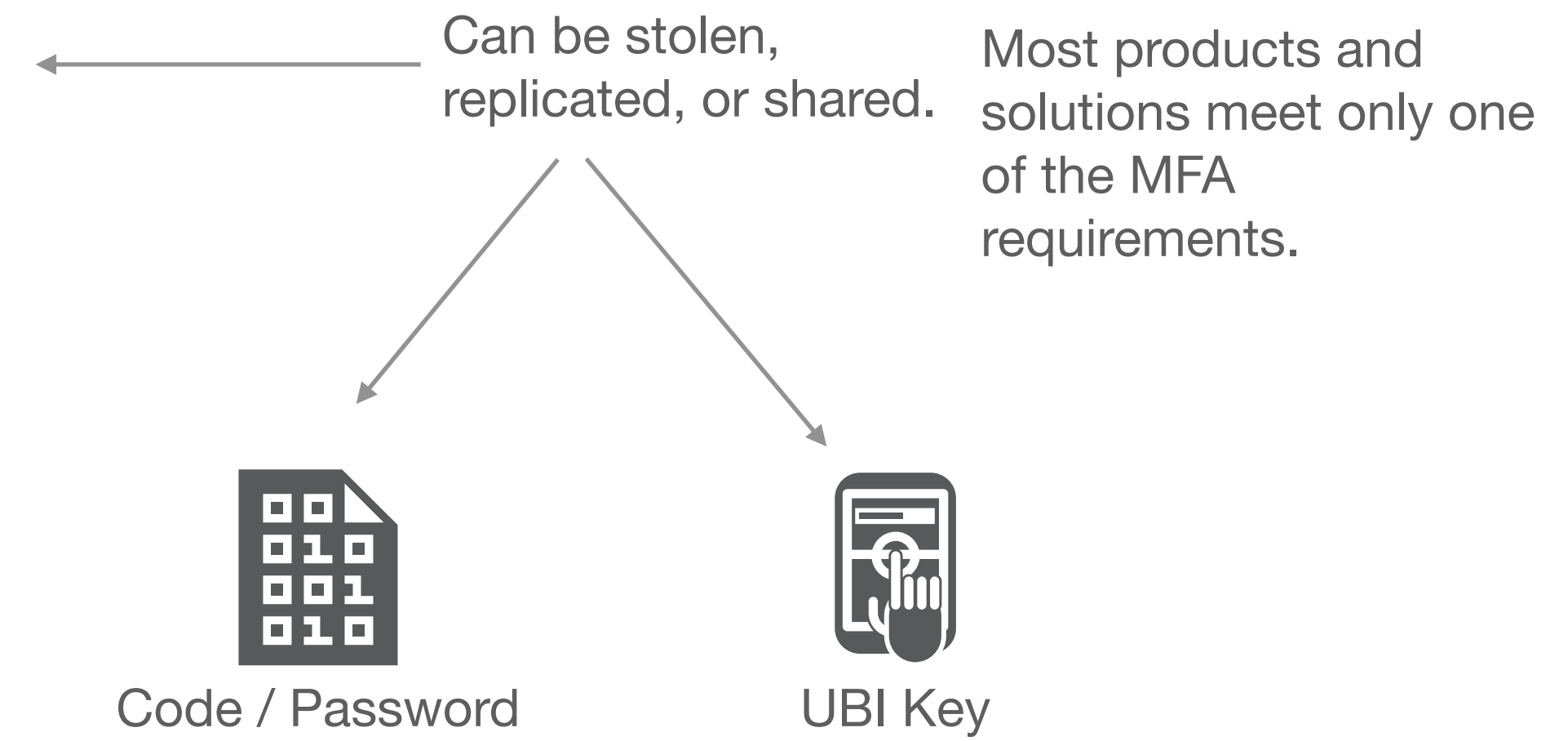
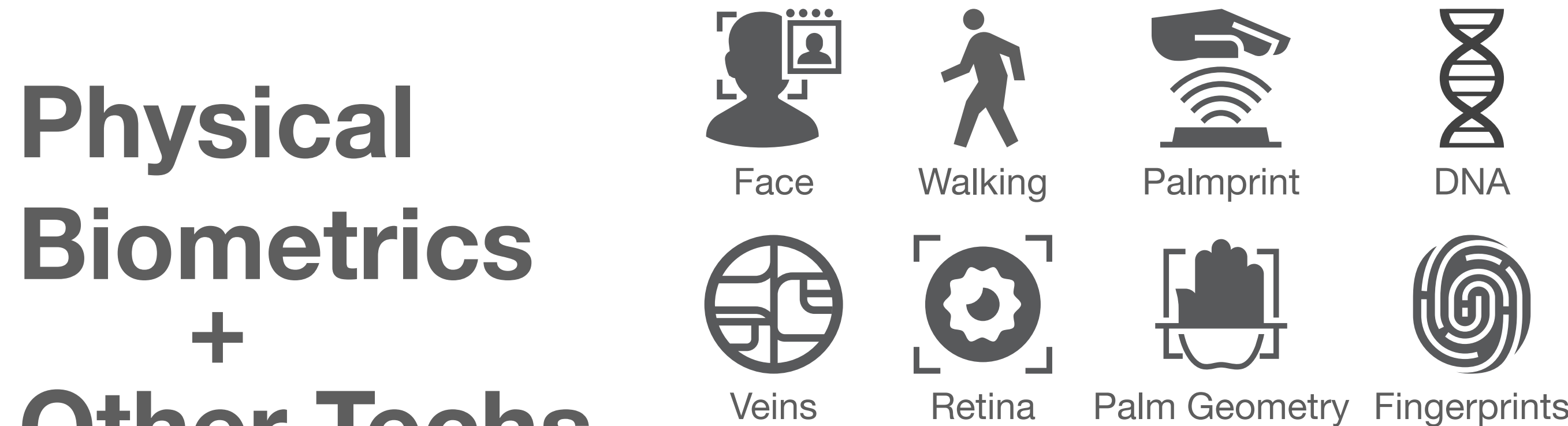
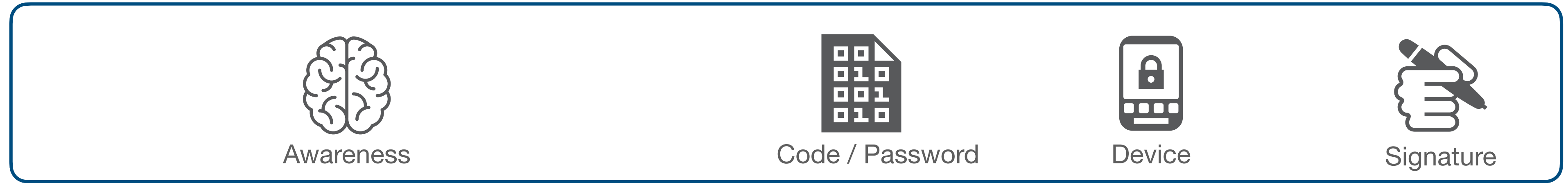
Physical Biometrics + Other Techs.

“Inherence”

“Knowledge”

“Possession”

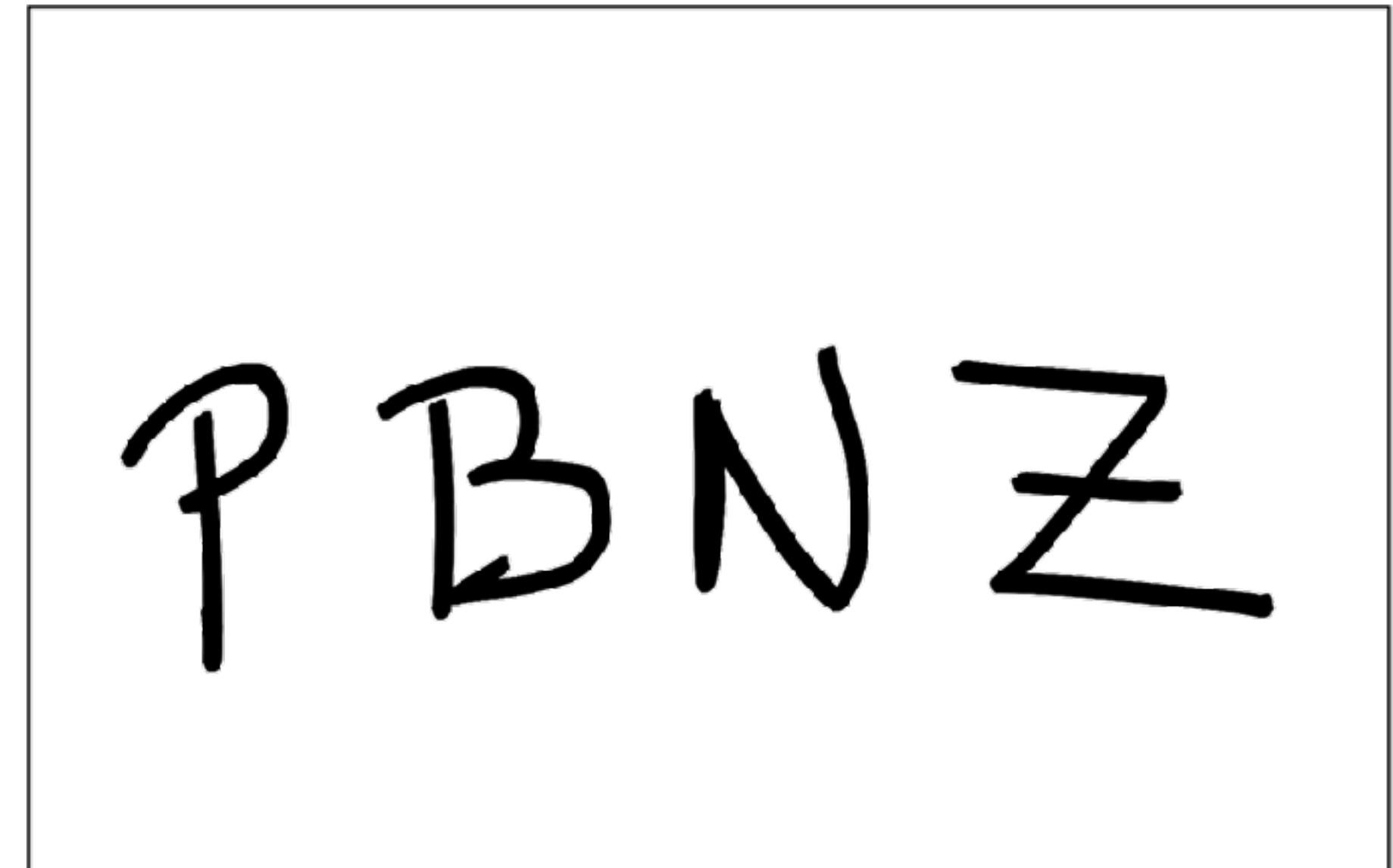
“Ability”



Behavioral biometrics

About *written / drawn* passwords...

- They are not authenticated as “calligraphy”
- It’s not about “pretty” it is all about “can you repeat it”
- Mathematically, nearly impossible to beat.
- Will “trip” a robot trying to replicate.
- Inherently “random”, yet “predictable”
- Easier to memorize (eg. Your signature)
- May require mental clarity / focus
- Don’t require training. Require proficiency.



**>BNs : 1 odds to hack....
Inherently random**

Behavioral biometrics

About written / drawn passwords...



Example 1



Example 2



Example 3

Same “code”, but not the same..

Behavioral biometrics

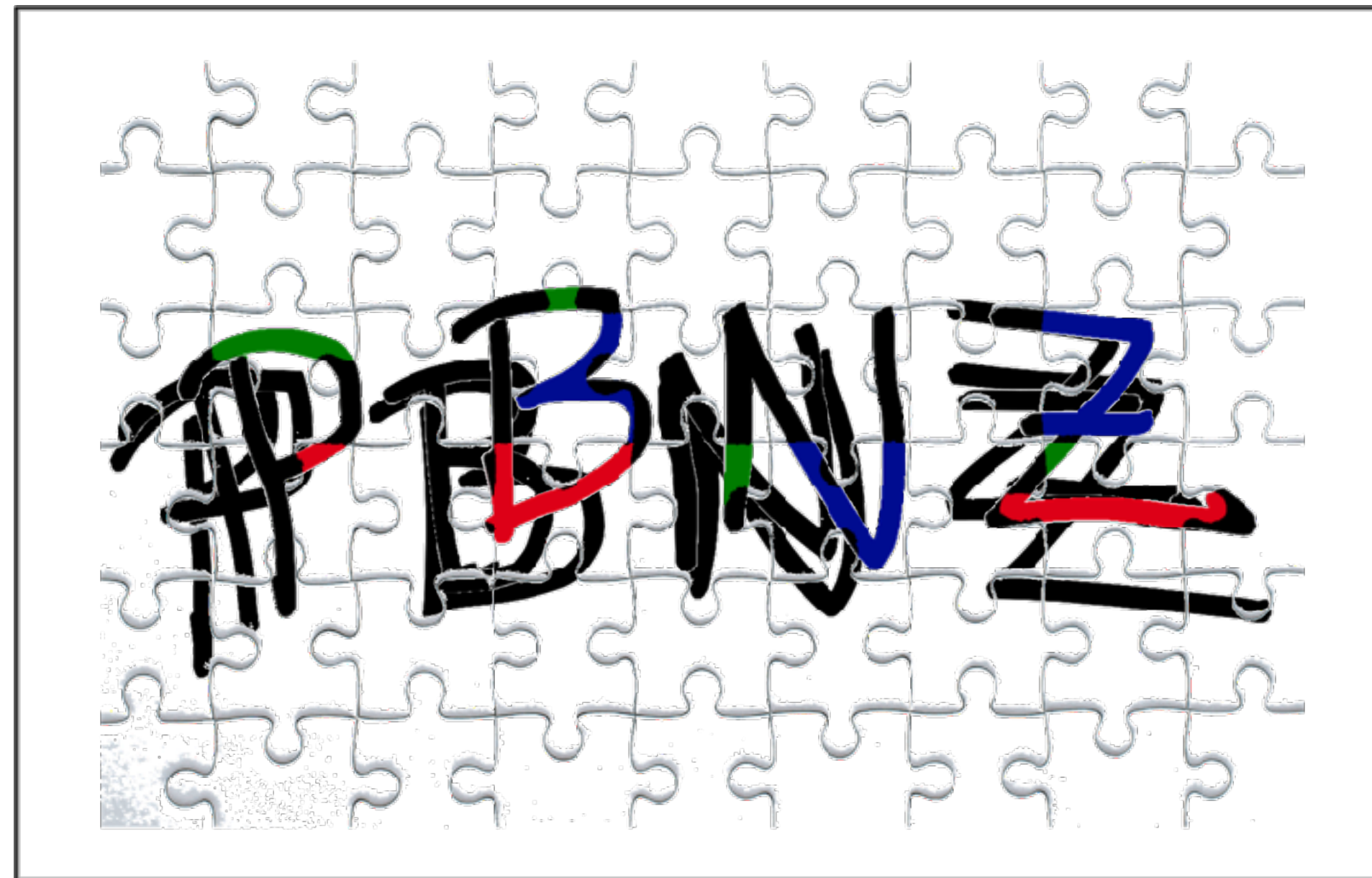
About *written / drawn* passwords...



It's not about comparing pictures...

Behavioral biometrics

About *written / drawn* passwords...



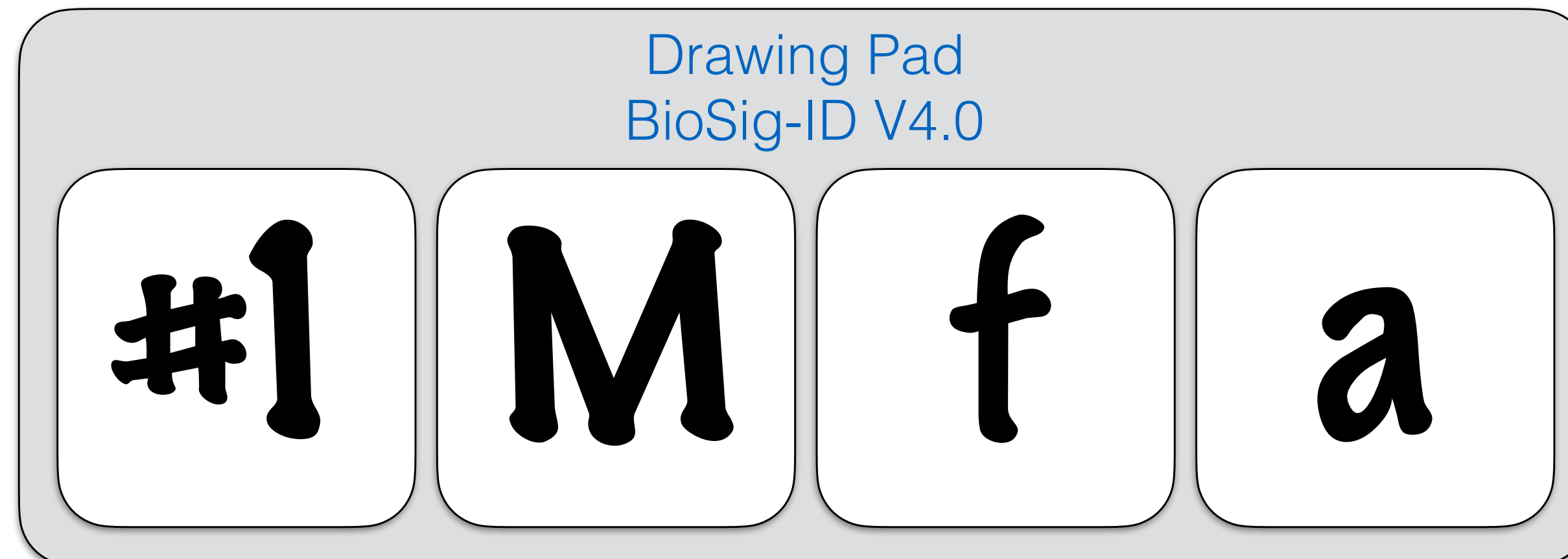
- **Random**
- **Inherent**
- **Ability**

It's about how only you can build the picture...

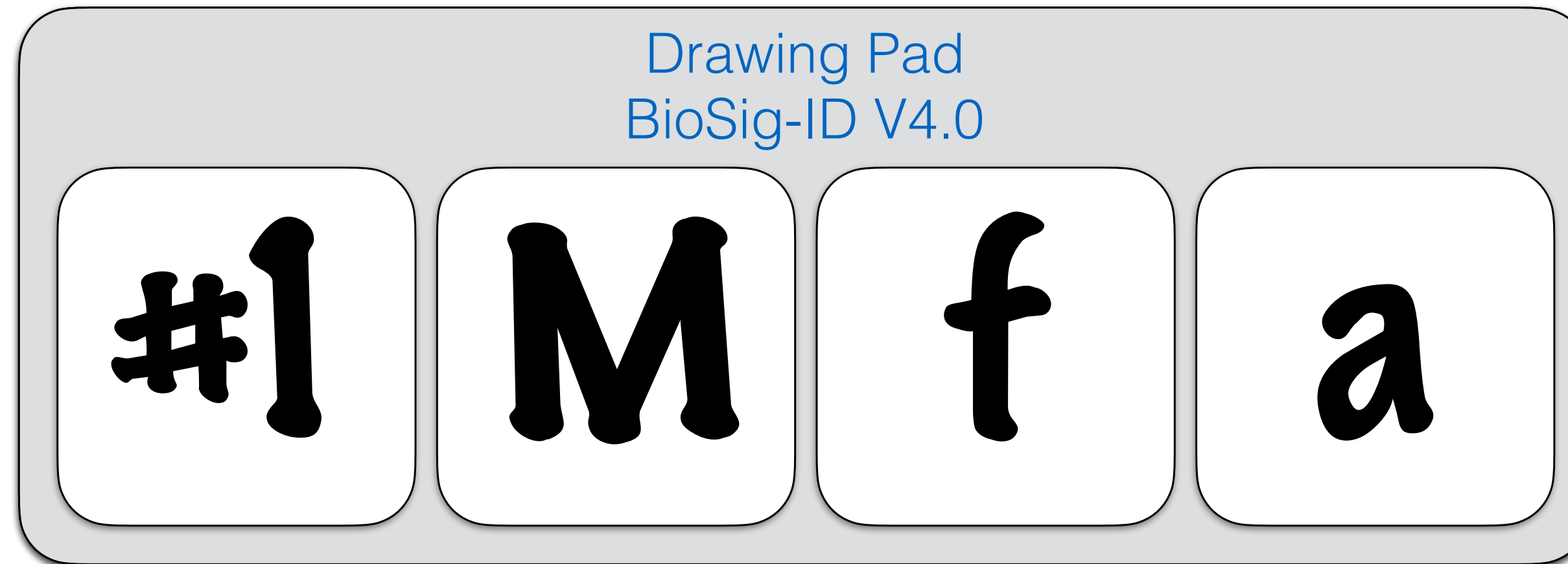
Unique and robust credentials



- Needs no special hardware
- Has no private identifiable information
- 192 billion to one link to a human
- Linked to user's state of mind
- All-at-once Advanced MFA
- Patented



Unique and robust credentials



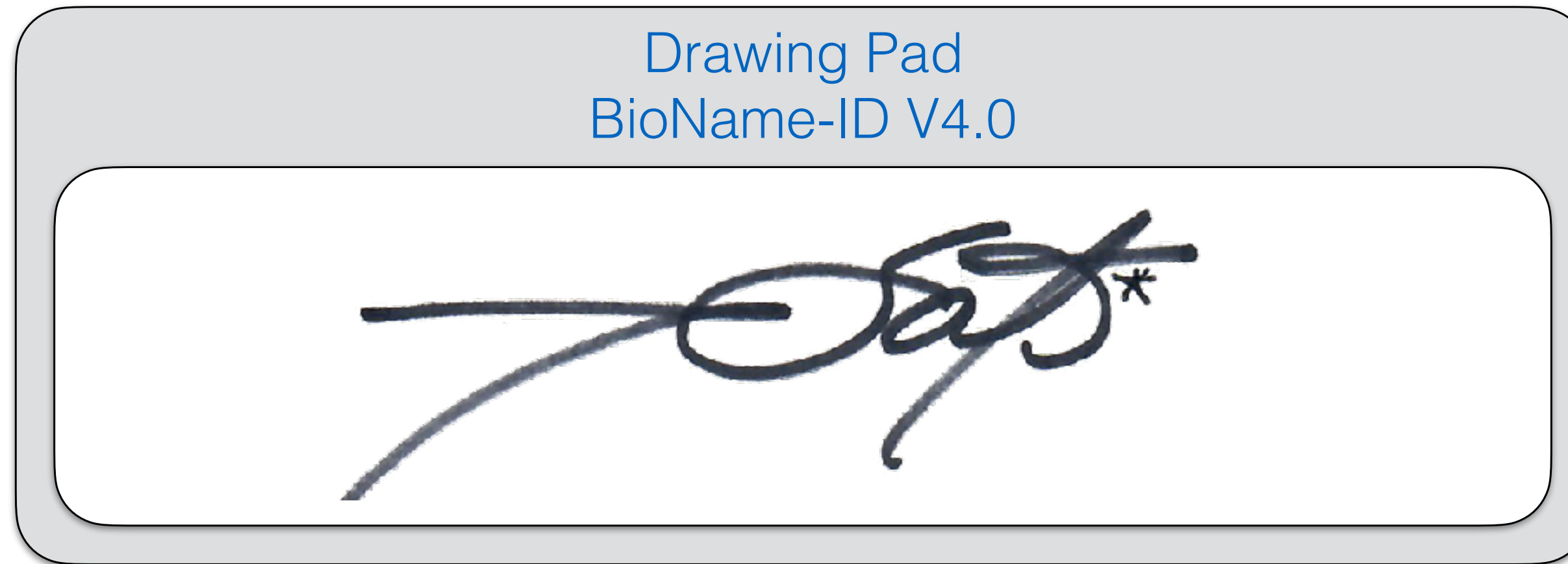
The “challenge screen” is presented to the user at any time validation is required in the process.

In one single action, the user meets all MFA requirements.

That's it.

Using a finger, mouse or stylus, the user writes their password.

Unique and robust credentials



A “signature” instead of a “pin” can also be used for different user experience.

In one single action, the user meets all MFA requirements.

That’s it.

**Secure and privacy
compliant proctoring for
remote assessments.**



**Biometric
Signature
ID**

Use behavioral biometric analytics to stop student cheating.

Deterrence and enforcement.

19APR2023 / Nelson Santini



**Biometric
Signature
ID**