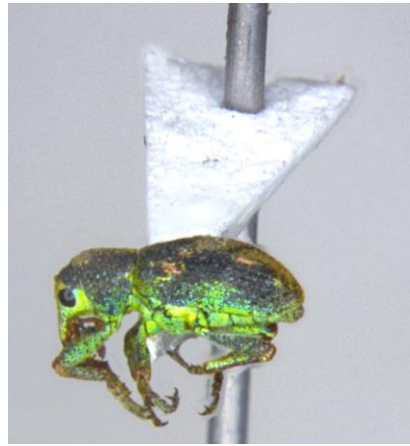


The Whole Point



A Concise History of Point-Mounted Insect Specimens

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We've been observing insects for a long time...

Man of Bicorp (c. 6000 BC)

- Earliest interactions w/ insects based on practical use
 - Image of man robbing honey from bees

Tomb of Rameses IX (c. 1000 BC)

- Insects as objects of worship

Aesopica (c. 600 BC)

- Behavioral qualities to various animals (incl. some insects)
- Perception of differences between different kinds of organisms

Aristotle's Historia Animalium (c. 343 BC)

- Aristotle's ladder
 - Description and organization of organisms (incl. some insects)
- Based on dissections and in situ observations of organisms
 - **Entomology!**
 - But not collections based



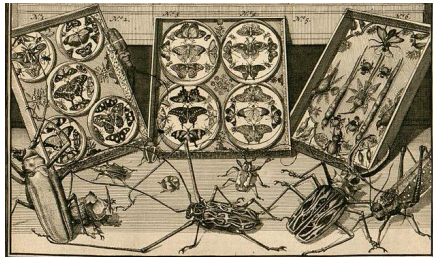
	Humans
	Mammals
	Birds
	Reptiles and amphibians
	Whales and porpoises
	Fish
	Squids and octopuses
	Lobsters, crabs, etc.
	Snails, clams, etc.
	Insects, spiders, etc.
	Jellyfishes, sponges, etc.
	Higher plants
	Lower plants
	Inanimate matter

Early Collections: Wunderkammer (Cabinets of Wonder)

1500s - 1700s : Proto natural history collections

Curiosities (both manmade and natural)
from around the world &
around the empire

**Including
insects**



Ferrante Imperato's cabinet
(*Dell'Historia Naturale*, 1599)



Ole Worm's cabinet
(*Museum Wormianum*, 1655)

Early Collections: Wunderkammer (Cabinets of Wonder)

Collectors had **LOTS** of money (or patrons with lots of money)

Ferrante Imperato: **employed by the Duke of Frías**

Ole Worm: **personal physician to King Christian IV**

Levinus Vincent: **wealthy Dutch silk merchant**

Early collections were displays of power and wealth for individuals

- Limited science being done with these materials until the 1700s

Little mounting: usually dried and placed on a shelf



Levinus Vincent's cabinet

(*Wondertooneel der Nature*, 1715)

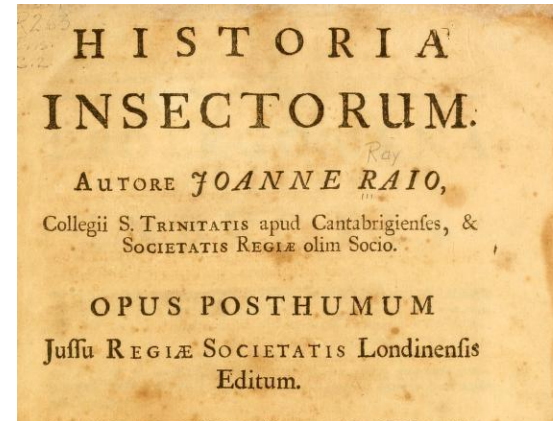
1700s:

A shift towards more organized collections

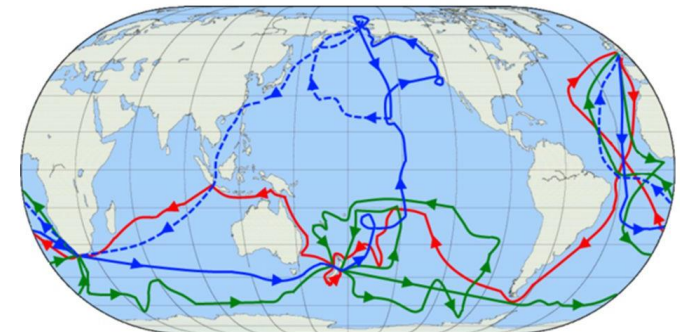
Shift away from specimens as status symbols; toward specimens as objects of scientific study

Shipping of specimens into Europe further mandated organization and space saving

“Place it on a shelf” no longer sufficed



One of the earliest attempts to classify insects (John Ray, 1710)



The routes of Captain James Cook's voyages. The first voyage is shown in **red**, second voyage in **green**, and third voyage in **blue**. The route of Cook's crew following his death is shown as a dashed blue line.

Linnaeus and his students

Beginning of the systematics craze

Linnaeus sent students across the globe to collect

Fabricius

- Basis of modern insect classification
- Described 9776 insect spp.



Most of these insect specimens were pinned



Carl-Friedrich Adler

And. Berlin

Carl-Friedrich Adler



And. Berlin

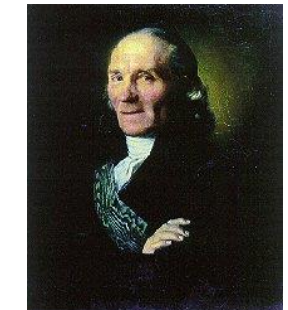


Daniel Rolander

Goran Rothman



Christopher Thunberg



Portraits, signatures, and artifacts of the 17 apostles of Linnaeus

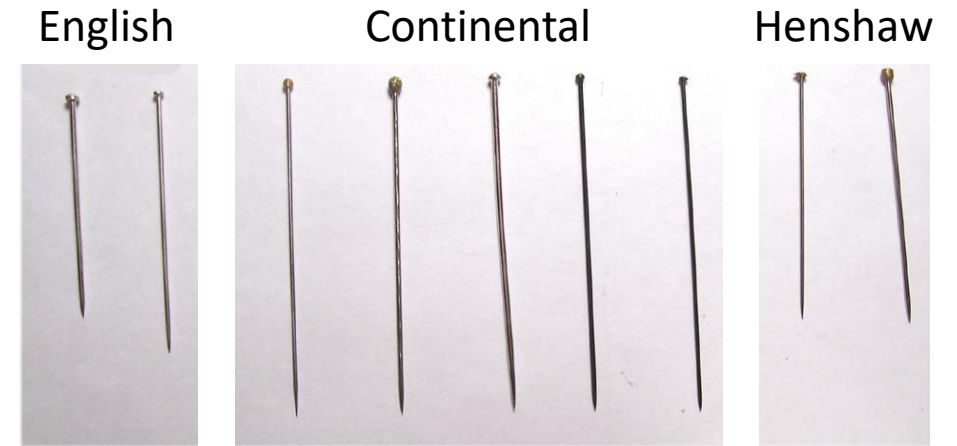
Early Insect Mounting: Pins

(1700s-1800s)

Pins give you something to hold onto and allow you to move and manipulate specimens

Also give you a convenient place to put a label – we start to see data associated w/ specimen

Earliest known pinned specimen: Bath white (*Pontia daplidice* L. 1758) collected in **May 1702** housed in the Oxford University Museum of Natural History



Pins are great and we still use them, but...

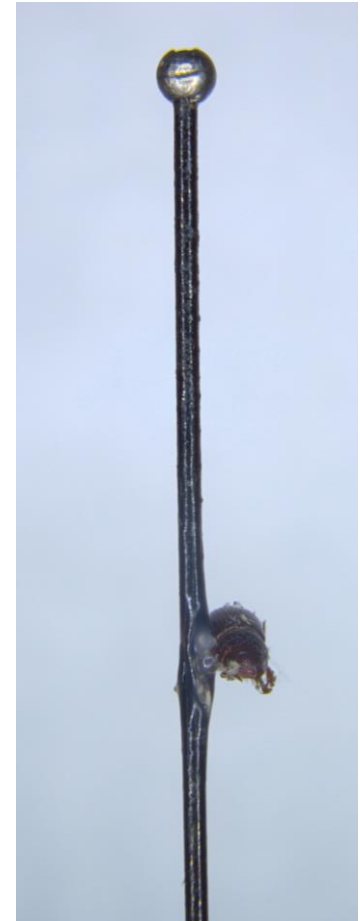
Problem: How do you deal with small things?

Left in alcohol

Shellacked or glued to the pin

Slide mounted

- Early slides of bone, wood, and ivory with mica coverslips
- 1840: Introduction of a standard size glass slide by the Royal Microscope Society



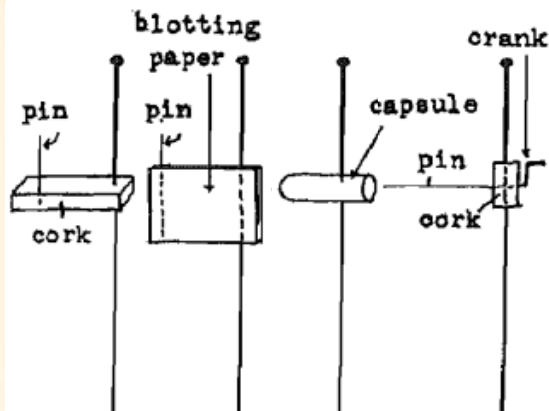
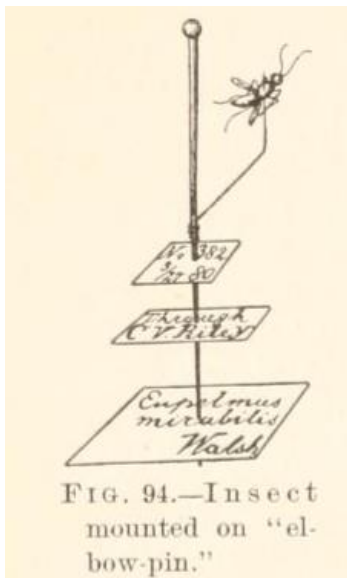
Double mounting: adding things to the pin

Elbow pins (Riley, 1892)

Minuten pins (“minutien nadeln”) (Riley, 1892) in blocks of various materials

Gelatin capsules (Felt, 1899)

Mead pins (Weis, 1915)



Material to hold minuten	Reference	Notes
Cork	Riley, 1892	
Jerusalem artichoke pith	McLachlan, 1873	Other plant piths have been promoted/ complained about throughout literature; “I say emphatically:– Use Artichoke Pith!” (McLachlan, 1893)
Felt	Mathews, 1893	Sometimes soaked in mercuric chloride or arsenic (Mathews, 1893)
Polypore mushroom	Blandford, 1895	
Cardboard	Felt, 1899	
Blotting paper	Cresson, 1913	
Silicone rubber	BioQuip web catalogue	
Polyethylene	BioQuip web catalogue	

Mounting on paper products: card mounts

Popular among European entomologists in the 1800s

Weird variations on cards from the NHM flickr (hooray for imaged specimens!):



Hypotelus micans Type - NHMUK010582765
<https://flic.kr/p/QR7wsy>



Euspilotus (Hesperosaprinus) inversus
(Lewis, 1899) Type Female
NHMUK011222335
<https://flic.kr/p/25jXmw2>



Cyliandropterus imbricatus Champion, 1906
<https://flic.kr/p/pL93j2>



Blysmia ruficollis Pascoe Holotype
<https://flic.kr/p/T9j4t2>

Problem: blocks out one side of the specimen

- Can make the specimen more visually appealing but less visible

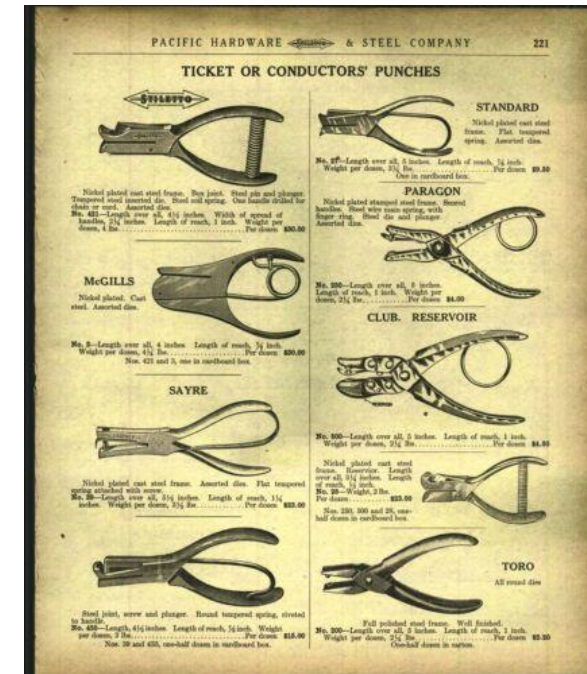
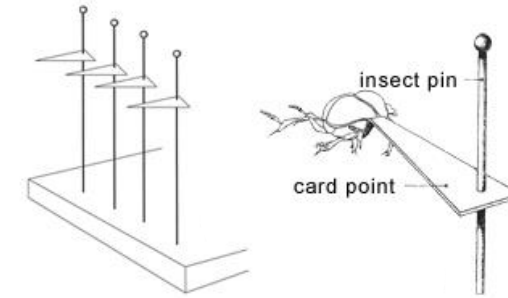
At some point, someone came up with the idea of cutting out a triangular card to make things more visible, **and thus the point was born**

Points

Allow for more visibility of the specimen than cards

Older points were cut with fine scissors

In the late-1800s conductors' ticket punches were co-opted (Riley, 1892)



Point production through the 20th century

Ultimately paper points prevailed: efforts to make points less obfuscating didn't catch on

- Mica (Riley, 1892)
- Gluing hairs to the point for particularly small things like ptillids (Dietrich 1931)
- Celluloid (Dietrich 1931)
- Clear plastics, e.g. cellulose acetate (Whelan 1941)









By 1930s points were apparently commercially available, but no source for them is given (Dietrich 1931)

Point production didn't change much in the following 100 years

Hand punch is still the primary method

- **Punches commercially available**

BioQuip's special value **1150A**, **1150B** (NSN: 3740-01-454-2344), **1150C** and **1150D** stainless steel point punches are imported.

1161A	Info	Point Punch, Round Base - USA	\$67.57	
1161B	Info	Point Punch, Square Base USA	\$67.57	
1161C	Info	Point Punch, Square Base, 9.2mm long, 2.7mm base, .7mm tip USA	\$90.98	
1161D	Info	Point Punch, Square Base, 11mm long, 3mm base, 1mm tip USA	\$90.98	
1150A	Info	Point Punch, Round Base, Import	\$45.41	
1150B	Info	Point Punch, Square Base, Import	\$45.41	
1150C	Info	Point Punch, X-Large, Round Base, Import	\$50.93	
1150D	Info	Point Punch, X-Large, Square Base, Import	\$50.93	

But there are issues with using hand punches

1. Repeated physical exertion leads to risk of repeated stress injuries
2. Wear of moving pieces of punch over time
 - Causes increasingly jagged edges of points
 - Causes increasing difficulty in punching per point punched
3. Human manipulation wastes quite a bit of material
4. Point punches disappear readily unless chained down
 - **Especially when being used in many-user settings such as the classroom**
5. Point punches produce one size and one shape
 - If you want another size and shape, you have to get a second punch
6. Point punches cost money

Economics behind buying a hand point punch

(in grad student terms)

BioQuip point punches range from **USD\$ 45.41 – 90.98**

let's use the lower end: **USD\$ 45.41**

1 packet of ramen: **USD\$ 0.28**



$45.41/0.28 = 162$ packets of ramen



Economics behind buying a hand point punch

(in grad student terms)

1 cheap beer from the local pub: **USD\$ 3.00**

$45.41/3.00 = 15$ cheap beers



Economics behind buying a hand point punch

(in grad student terms)

1 ECN student early registration fee: **USD\$ 40.00**

$45.41/40.00 = 1.13$ **ECN meetings**

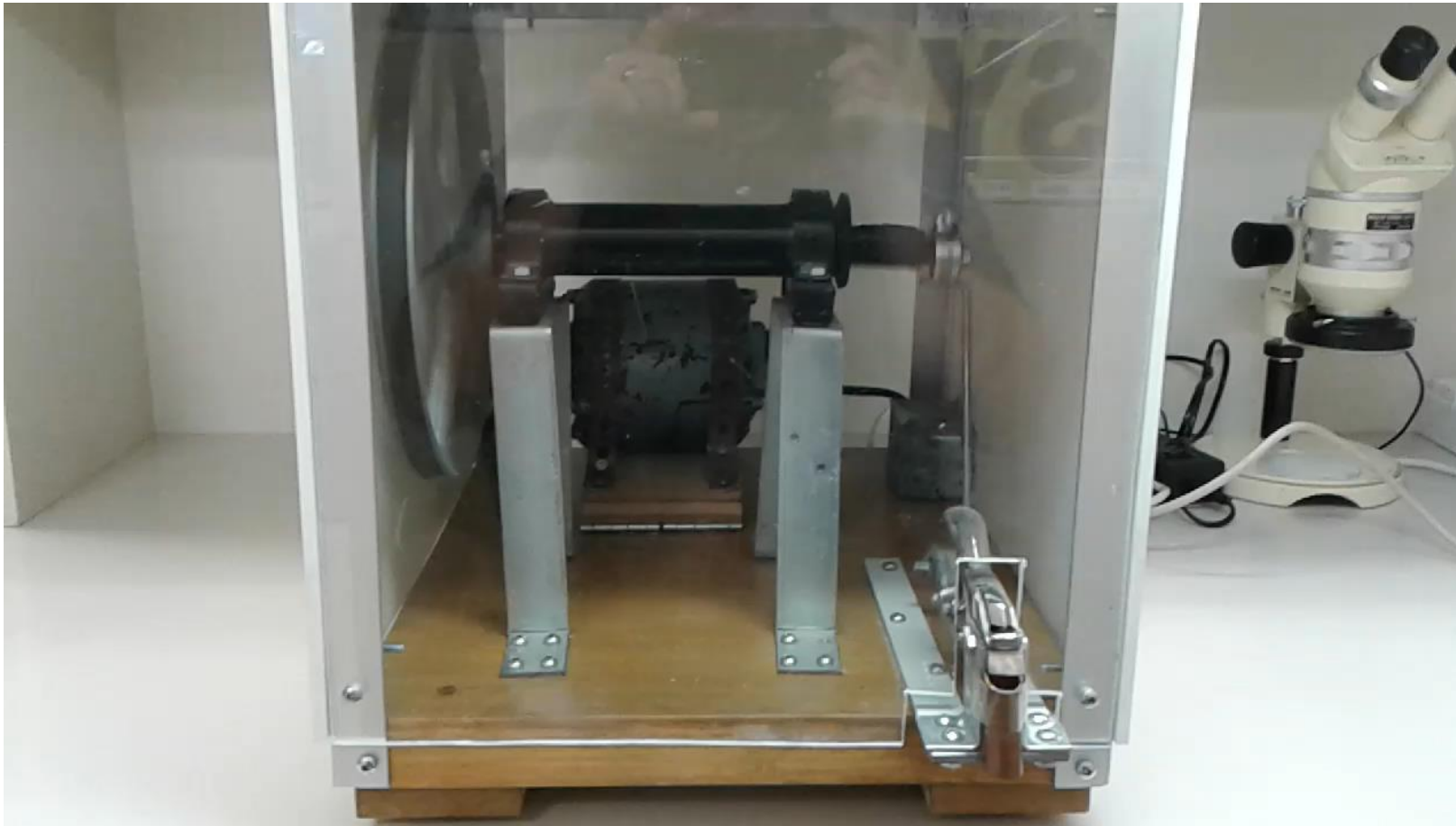


I can go to a conference and have money left over for a beer and a few packets of ramen for what I'd pay for the cheapest point punch.

Hand punches have problems!

1. Repeated physical exertion leads to risk of repeated stress injuries
2. Wear of moving pieces of punch over time
3. Human manipulation wastes quite a bit of material
4. Point punches disappear readily unless chained down
5. Point punches produce one size and one shape
6. Point punches cost money

A partial solution: point punching machines

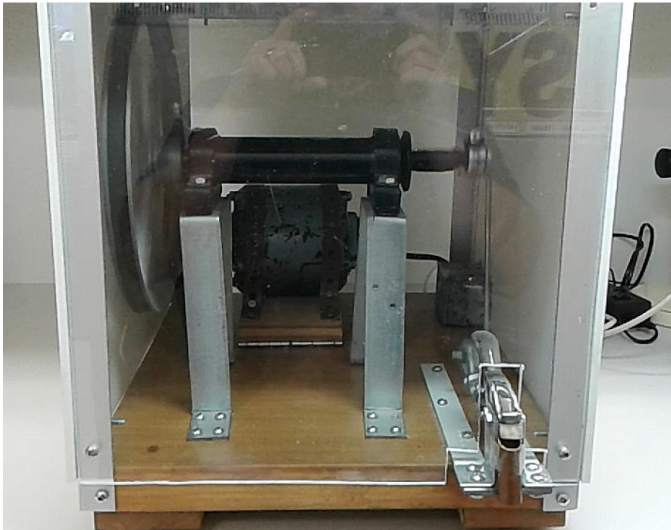


Video by François Génier at CNC

Point punching machines: pros and cons

Pros

- Increased overall speed
- Decreased hand strain



Maybe this is good enough for your needs!
Great!

Cons

- Wear and tear on the punch is the same
 - Still the potential for jagged edges due to tearing
- Hand-feeding paper = wasting some paper
- Still only one size and shape
- You have to build them yourself
 - The design that exists still involves you buying a hand punch!

This is 2018: we can cut things with lasers!

Desktop laser cutters are a few hundred to a few thousand dollars – **that's a lot!**

But many universities have makerspaces with laser cutters that are free-to-use for students and faculty

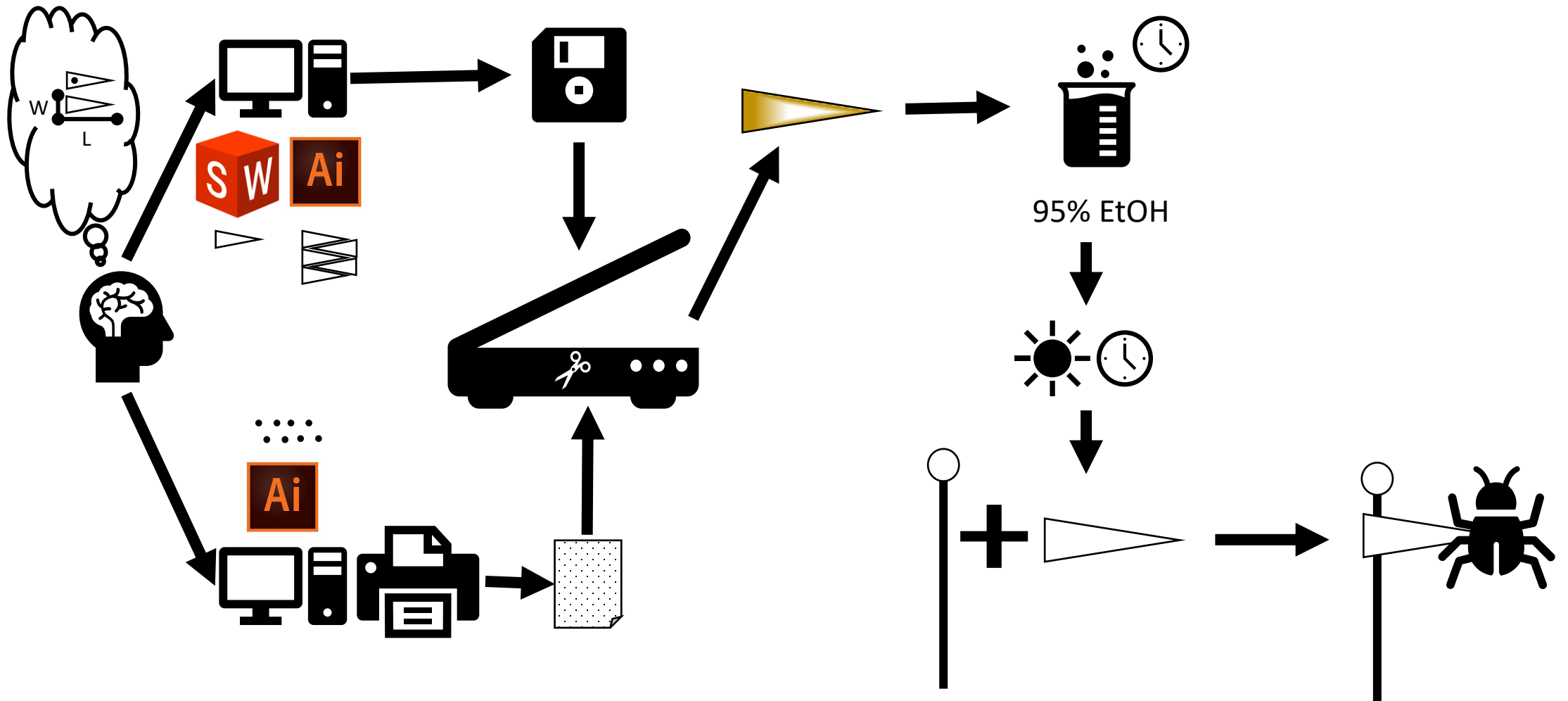
- Also makerspaces at many public libraries, schools, and community centers

This is in use right now: laser cutters have been in use for over 10 years for point production (Gary Alpert pers. com.)

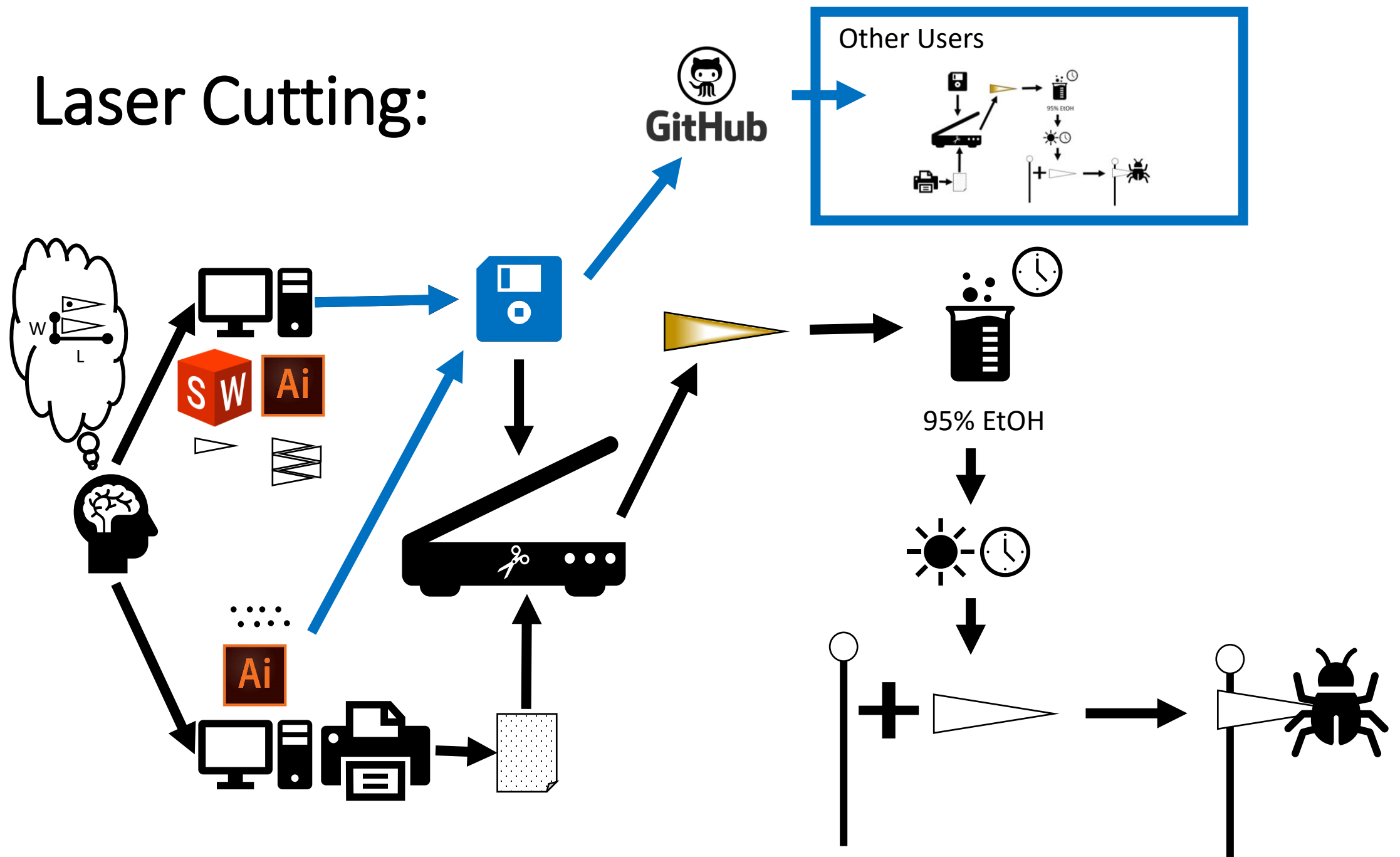
- **Yet very few people use this method**



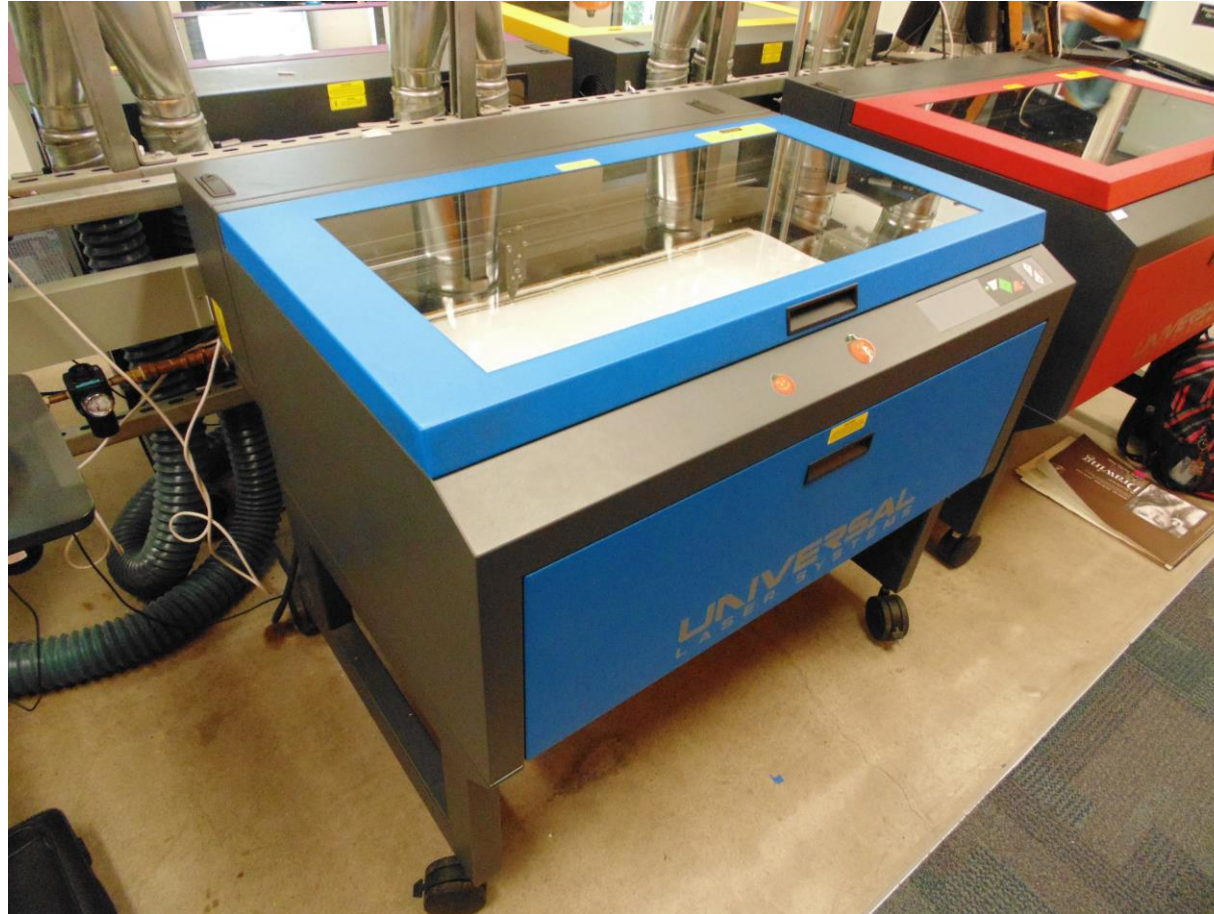
Laser Cutting:



Laser Cutting:



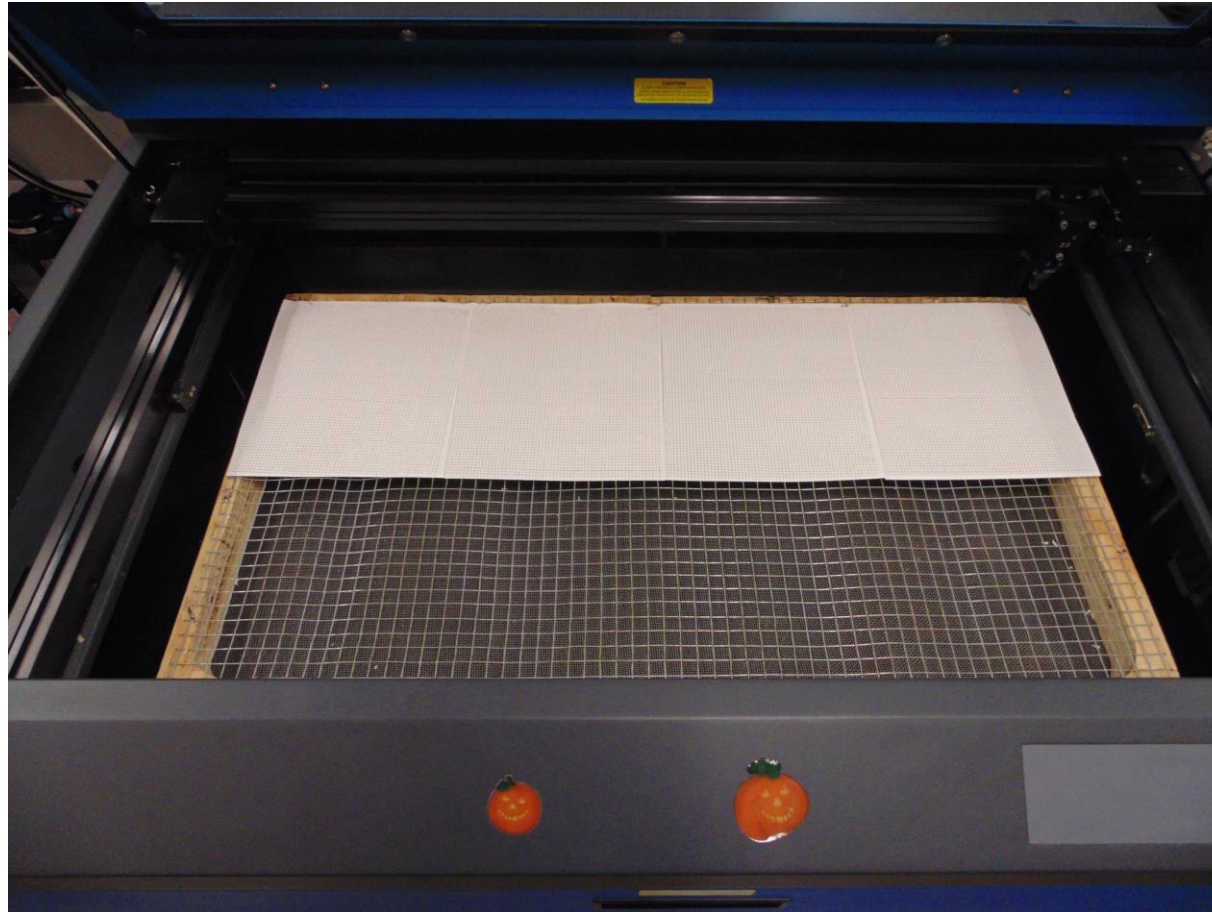
Laser cutting action shots



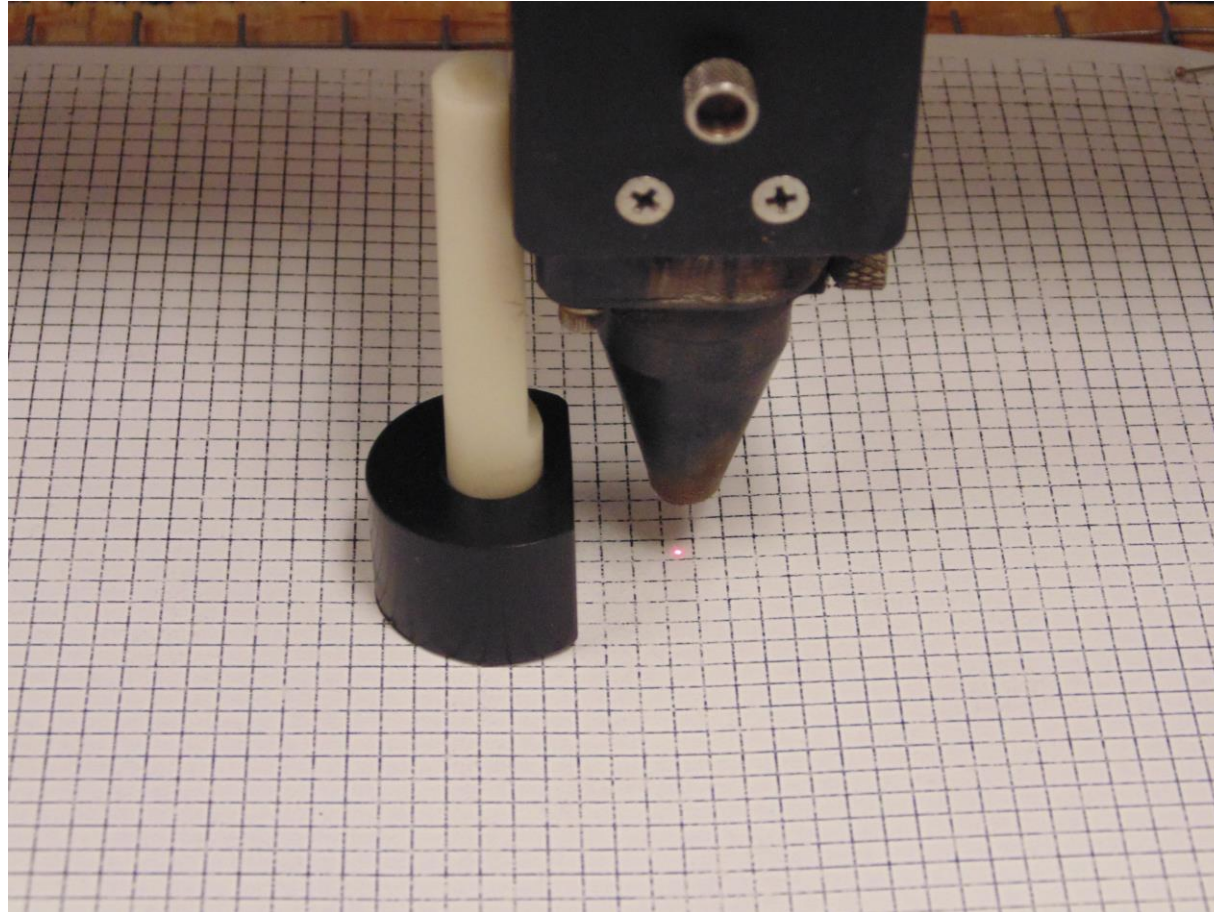
Laser cutter (with pumpkin stickers)



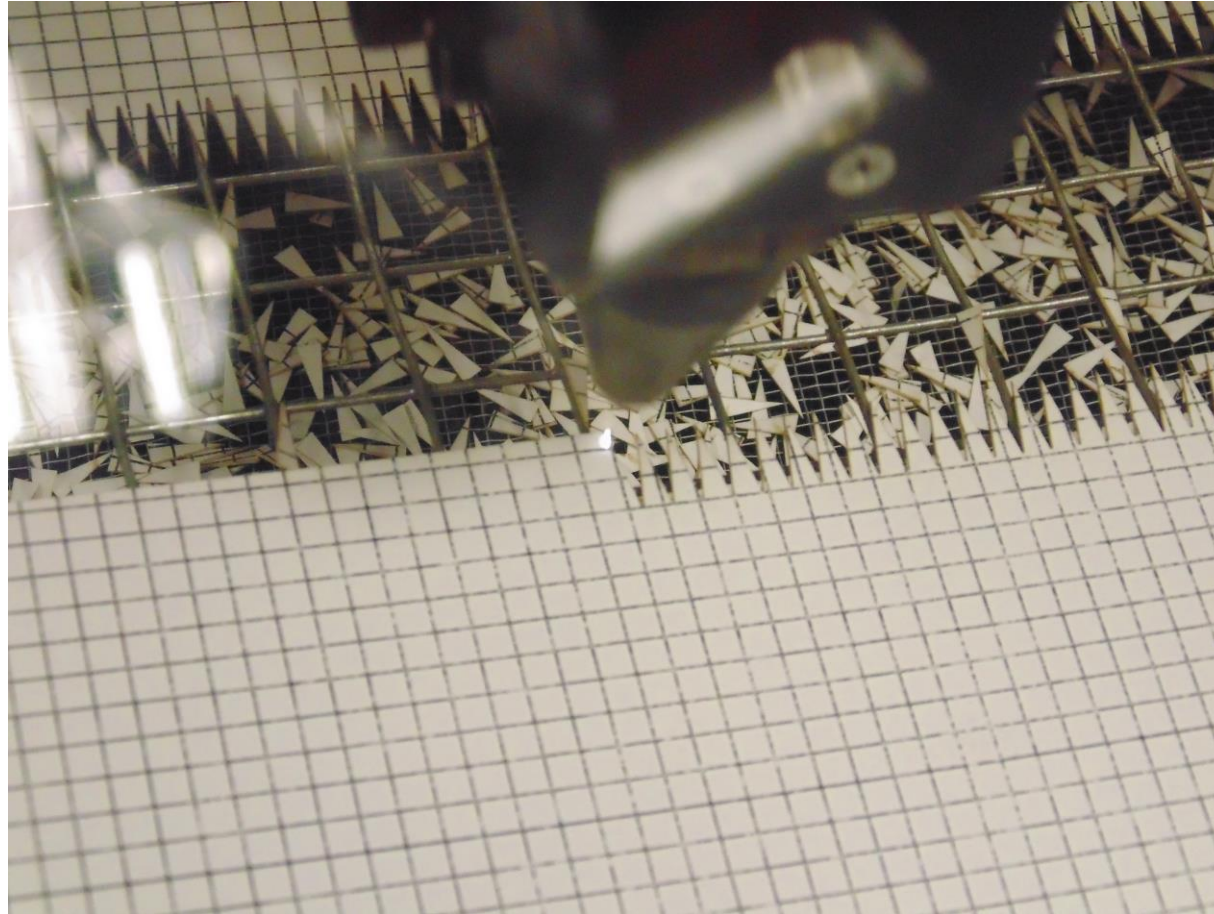
Tray to catch the points



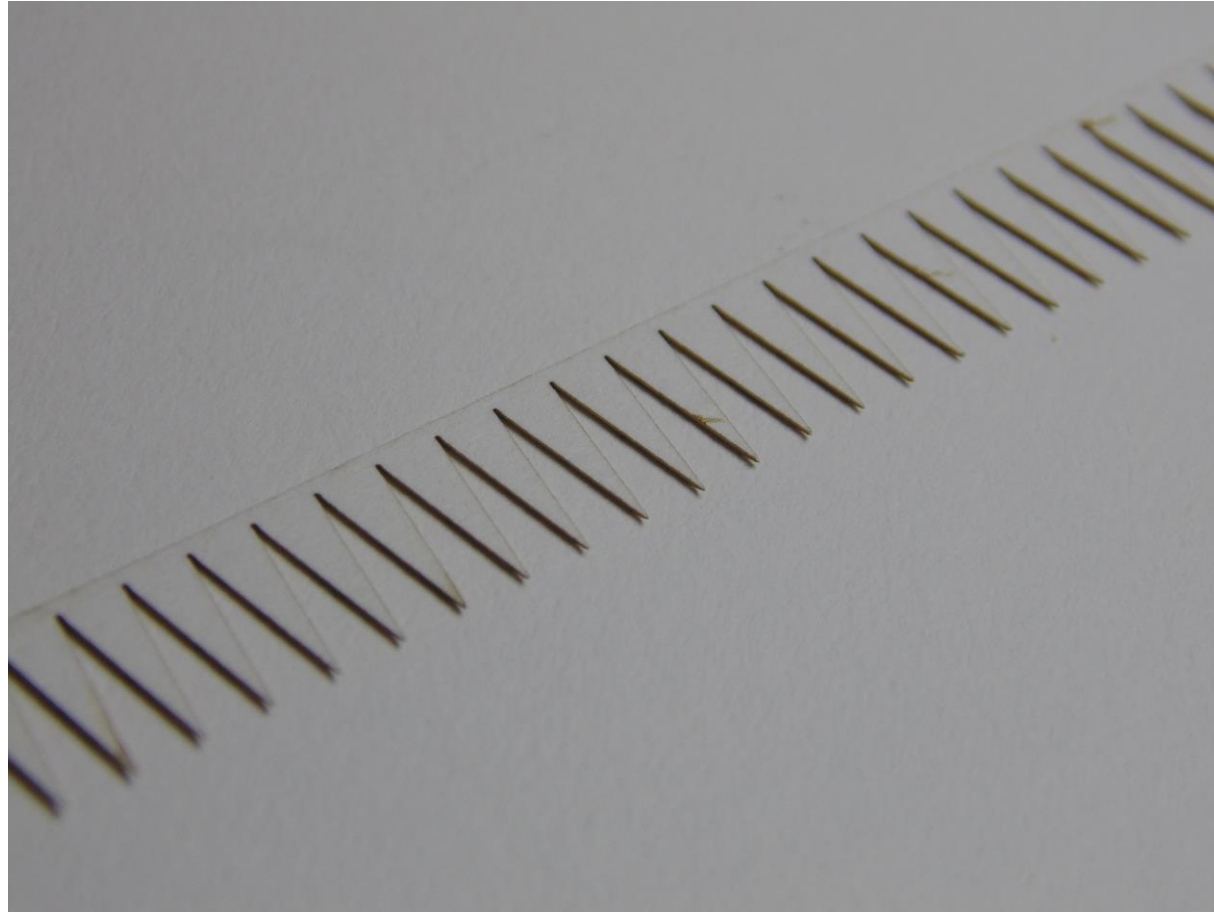
Leveling the laser



Cutting points



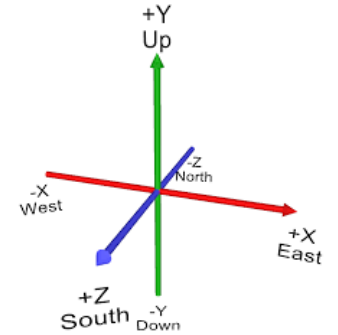
Points in strips...



... or in piles



Laser cutting: pros and cons

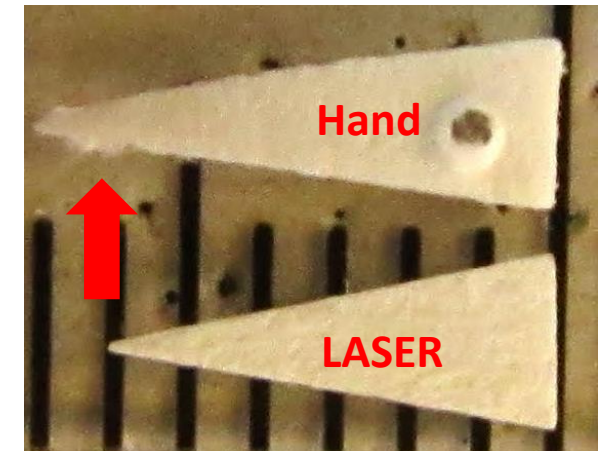
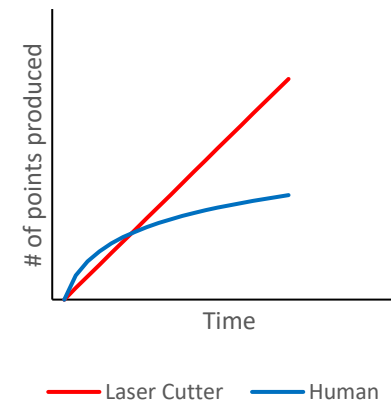


Pros

- Increased overall speed for larger numbers of points
 - May be slightly slower for only a few points
 - **Humans slow down, machines don't**
 - **A recent redesign of cutting pattern has now allowed us to out-pace humans!**
- No cutting surface = no wear
 - No wear = no jagged edges
- Very little paper wasted
- Points can be pretty much any size and shape you want
- Decreased hand strain

Cons

- Cutting curves takes a long time
 - Every movement must be done as x-y-z coordinates because of stepper-motors
 - This will probably improve with tech improving
- Initial expense is higher if your institution doesn't already have a machine



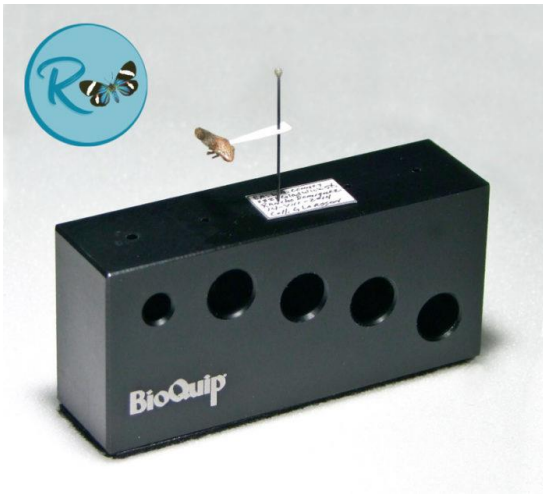
We made slightly better points. Who cares?

Think of this as a case study.

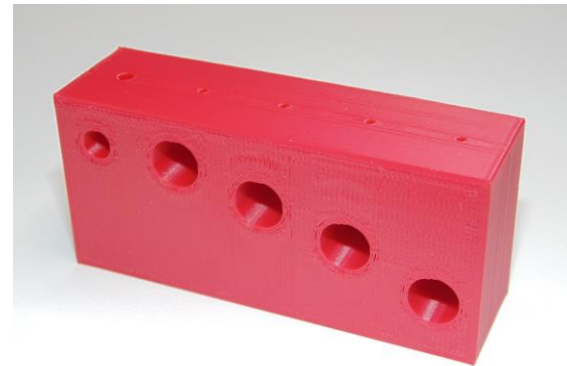
We made slightly better points. Who cares?

Think of this as a case study.

We are still using machine-shop techniques from the early 1900s to make most of our collections supplies:



\$39



<\$1

We made slightly better points. Who cares?

Think of this as a case study.

We are still using machine-shop techniques from the early 1900s to make most of our collections supplies:



\$219.50



\$34.60



<\$1

Commons Based Peer Production

Templates can be shared on filesharing platforms like GitHub

Our GitHub link:

<https://github.com/western-entomological>

Those in need of supplies can either design them themselves or commission creators (e.g. WIRG) to design them



Overview:

Modern production techniques are underutilized in our field.

More accessible, equipped makerspaces allow for more innovation via modern production techniques.

This reduces cost, which increases access to needed supplies.

More access to supplies = More science being done

And doing more science, so we can better understand our world, is **the whole point.**



Thank you!

Mike Ferro

Bill Warner

Gary Alpert

François Génier

Nico Franz

Sangmi Lee

Salvatore Anzaldo

Andrew Johnston

Christopher Wirth

Chad Hauck

Collections workers everywhere, for doing the difficult task of collecting and maintaining one of our most fundamental sources of knowledge about the natural world.



Questions? Comments?

WIRG: Brian Reily & Andrew Jansen

western.entomological@gmail.com

We're around at the break and have prototypes of the supplies we've been making!

Come try them!

Come talk to us about your collections needs!

