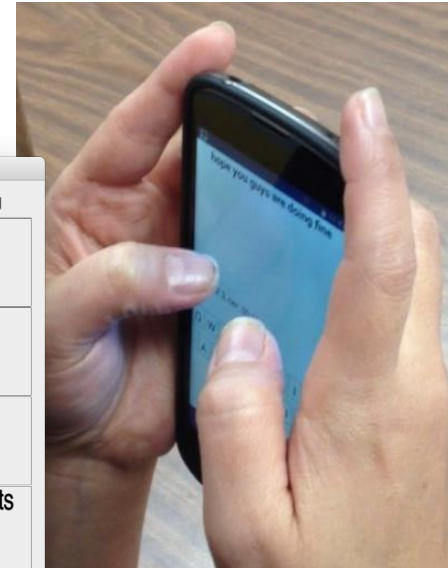
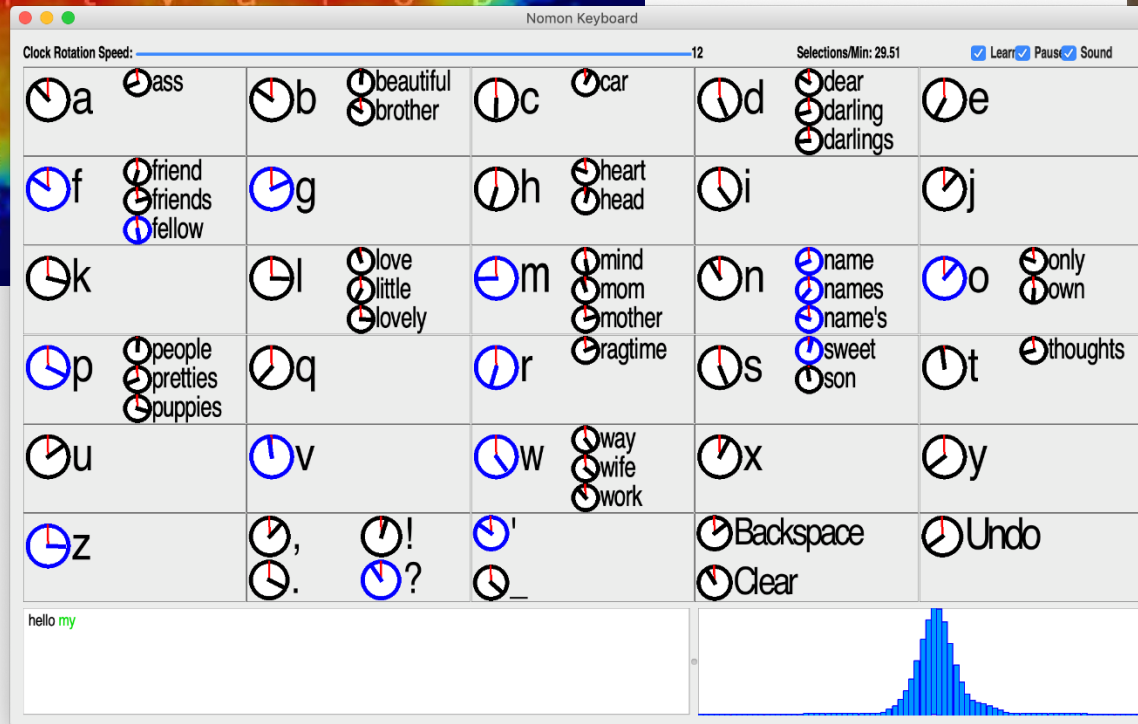
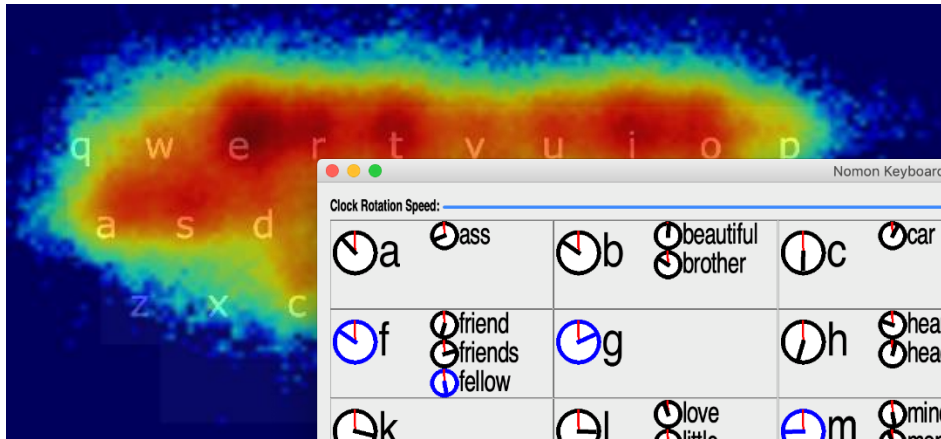


Natural Language Processing for Assistive Technologies



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**Michigan
Technological
University**

Augmentative and Alternative Communication (AAC)

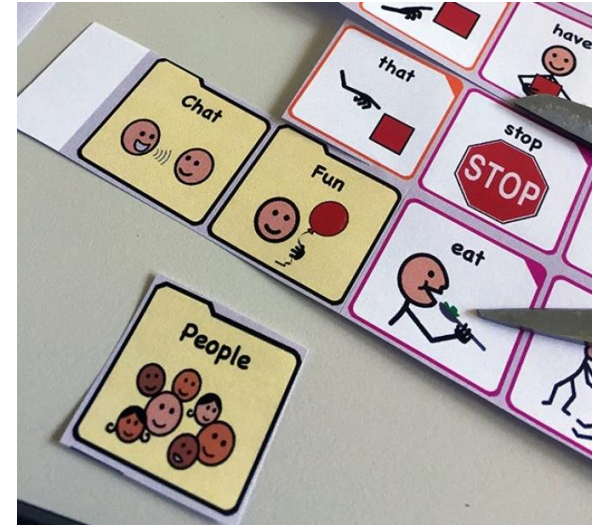
- **Communication without speech**
 - Wide range of options, reflecting range of users
 - Differing motor abilities
 - Differing cognitive abilities
 - May or may not be literate
- **No tech**
 - No extra tool or device requires
 - E.g. gestures, body language, pointing, facial expressions, sign language, eye movement, non-verbal vocalizations
 - May be difficult for people unfamiliar with user

Augmentative and Alternative Communication (AAC)

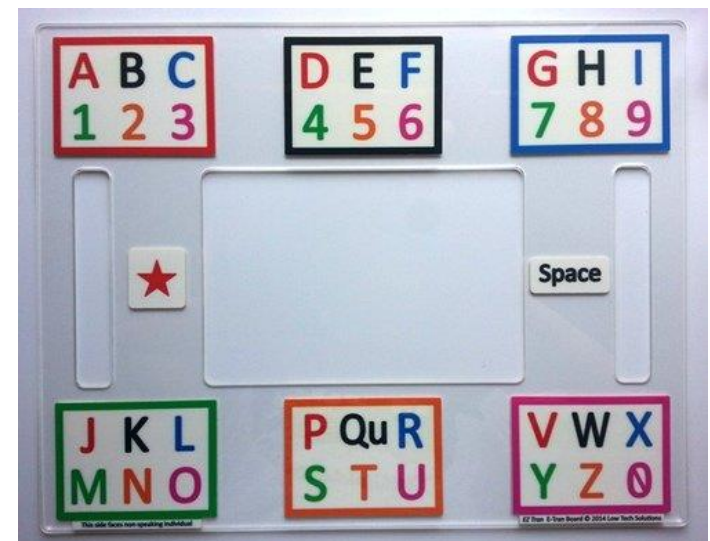
- Low-tech AAC
 - Paper
 - Communication board



<https://www.communicationmatters.org.uk/page/communication-cards>



<https://www.assistiveware.com/blog/making-a-paper-based-aac-book>

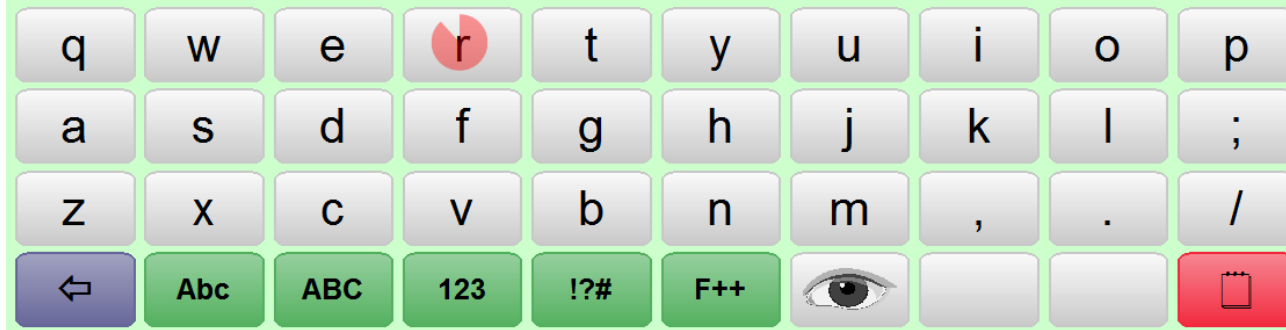


Augmentative and Alternative Communication (AAC)

- **High-tech AAC**
 - Device speaks or produces text
 - Speaking users: 150+ words-per-minute
 - Literate AAC users: often < 10 wpm



Writing with your eyes



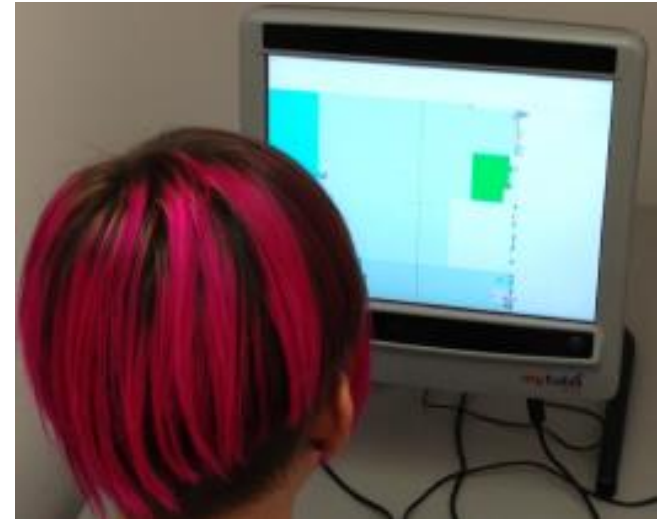
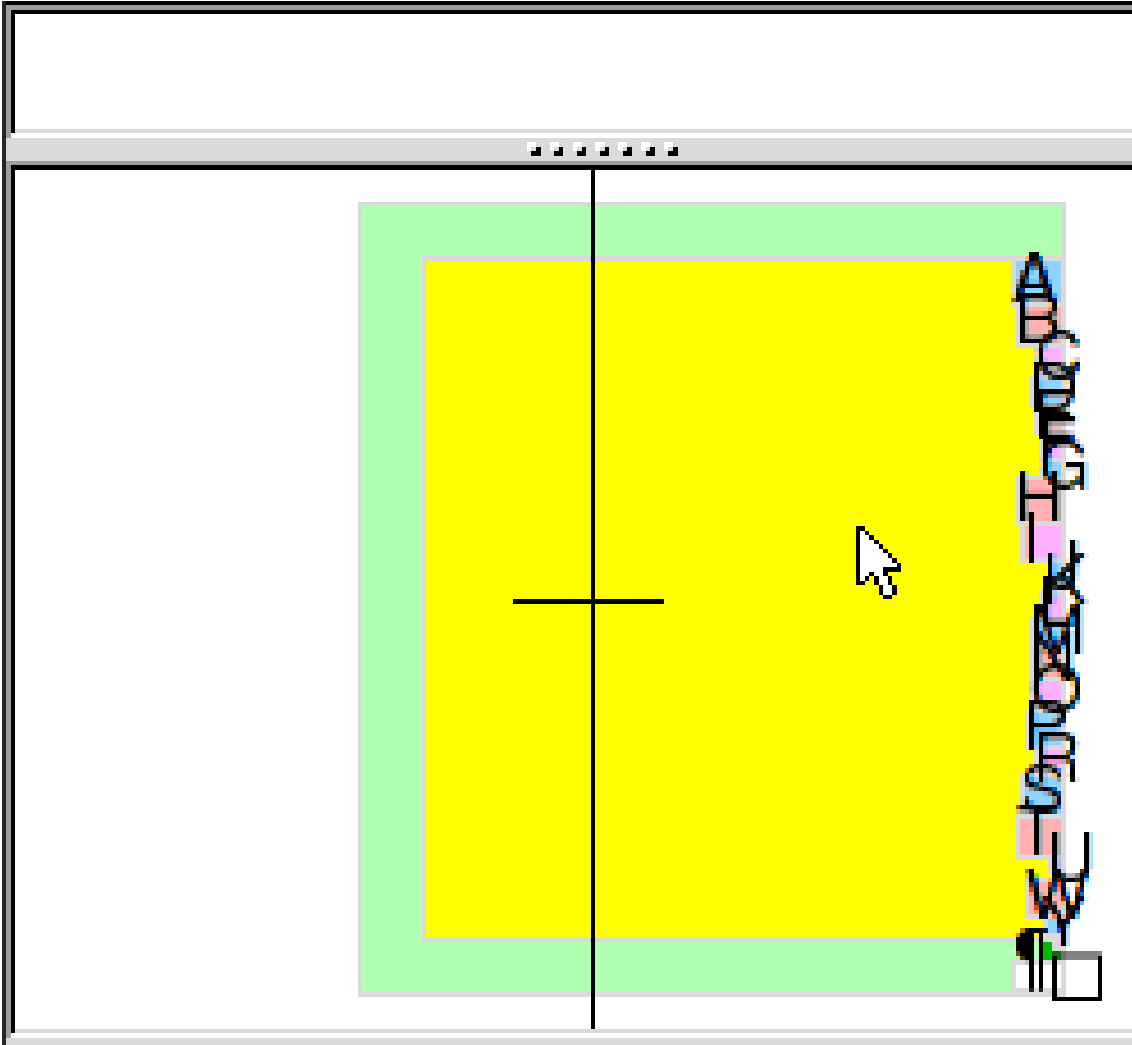
Dwell-clicking

~6 wpm

(words-per-minute)



Writing with your eyes



Dasher navigation

~14 wpm

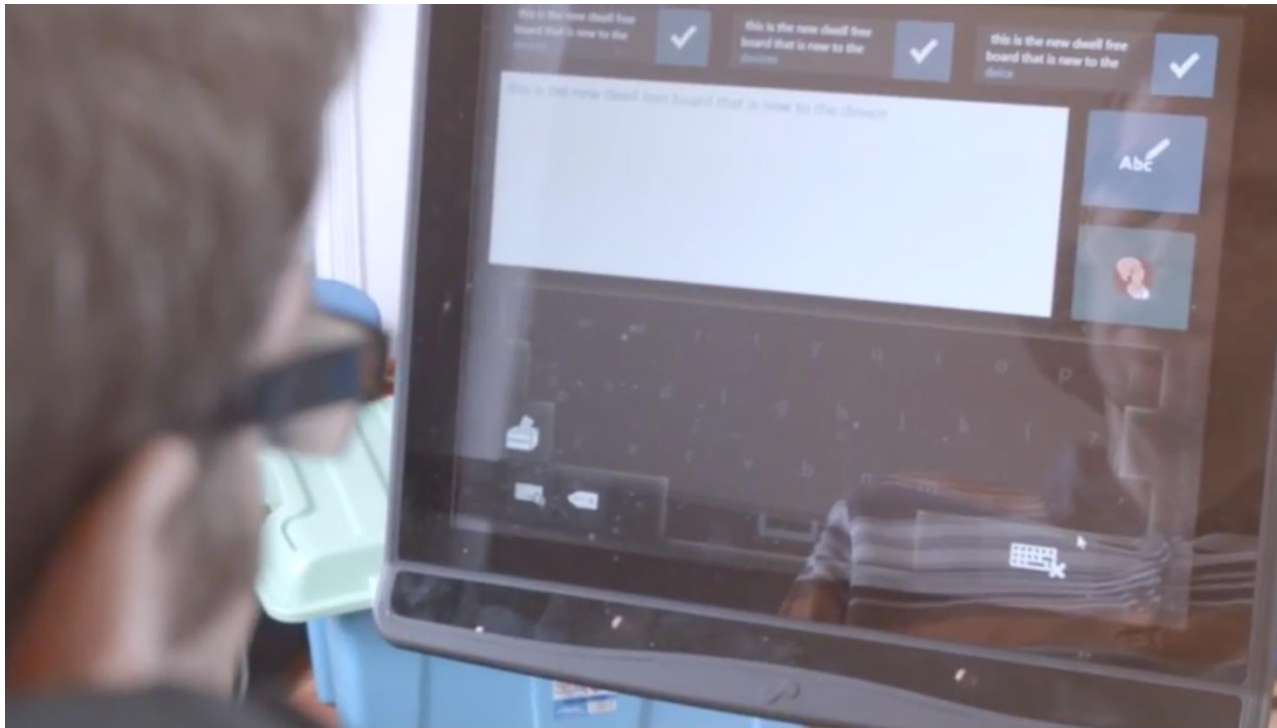
Writing with your eyes ●

q w e r t y u i o p
a s d f g h j k l '
z x c v b n m .

Dwell-free
eye-typing

Potential:

46 wpm



Writing with a single switch



<https://www.wired.co.uk/article/stephen-hawking-intel-communication-system>



space	E	A	R	D	U
T	O	I	L	G	B
N	S	F	Y	V	J
H	C	P	K	Q	.
M	W	X	Z	,	?

Row-column
scanning
~3 wpm

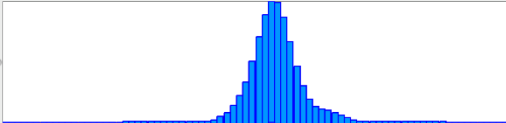
Writing with a single switch

Nomon Keyboard

Clock Rotation Speed: 12 Selections/Min: 29.51 ☒ Learn ☒ Pause ☒ Sound

a class	b beautiful brother	c car	d dear darling darlings	e
f friend friends fellow	g	h heart head	i	j
k	l love little lovely	m mind mom mother	n name names name's sweet son	o only down
p people pretties puppies	q	r ragtime	s	t thoughts
u	v	w way wife work	x	y
z	, . ! ? ' _	Backspace	Clear	Undo

hello my



Nomon:
~6 wpm



Dr. Tamara Broderick



Mr. Nicholas Bonaker



Dr. Emli-Mari Nel



Dr. Keith Vertanen

Nomon activity

- **Login into Windows**
 - Usernames: bonzai21-35 Password: Explore-19
- **Start Nomon**
 - Nomon folder on H: drive, keyboard.exe
 - Choose any user number (0 is fine)
 - Agree to having your clicks recorded
- **Play around writing sentences**
 - Try different clocks, keyboard options, speeds
 - When done: Tools -> Compress Data

Paired activity

- Pair up with one other student
- Best of three: rock-paper-scissors
- Loser:
 - Invent a communication situation
 - e.g. talking with family member, friend, someone you just met, shopkeeper, ...
- Winner:
 - You can't talk, use Nomon instead!
- Talk for several minutes

Character language modeling

Call me Ishmael. Some years ago- never mind how long precisely- having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and

What letter comes next?

It was a?

I want to go to t?

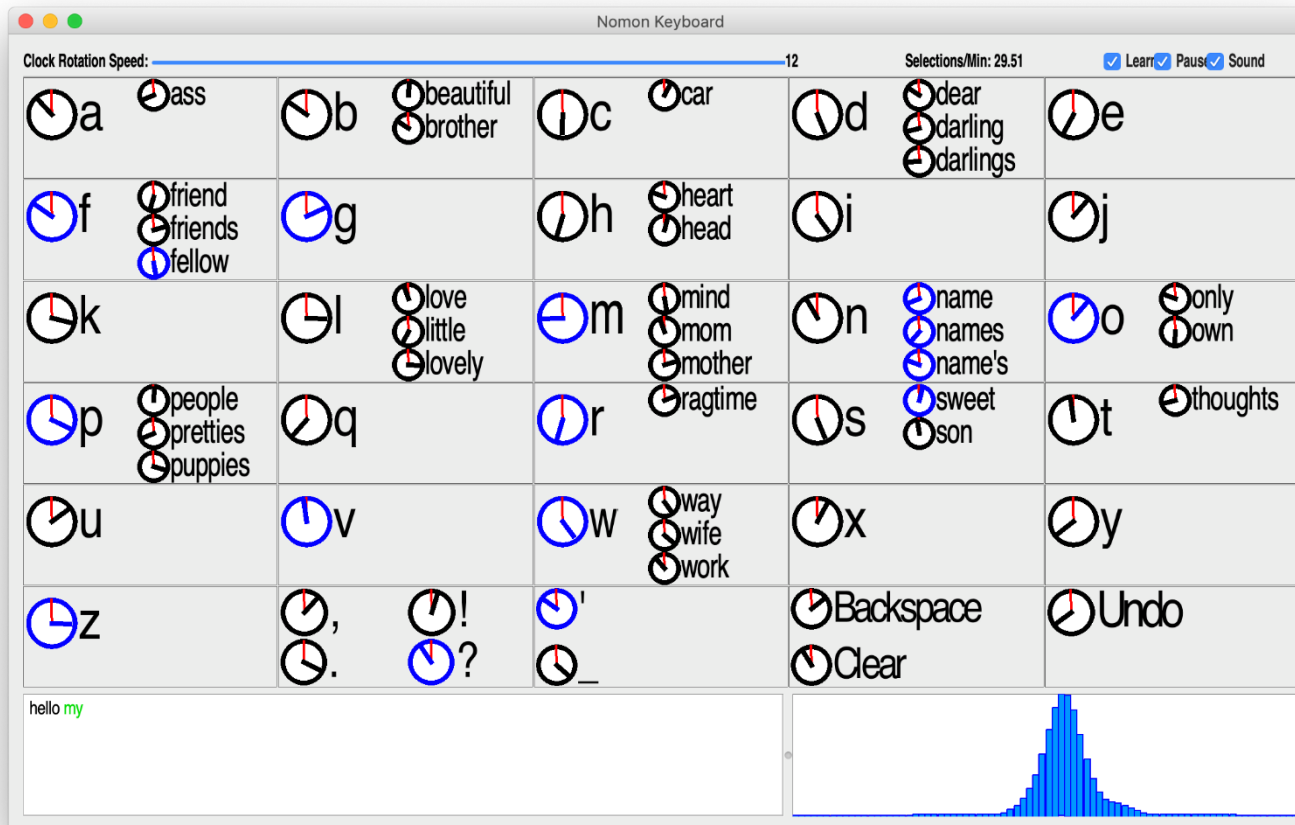
n-gram	count
aa	4
...	
am	1695
an	10435
ao	14
...	
tg	2
th	15570
ti	4246
...	
zz	42

Word language modeling

What word comes next?

Can you send ???

I want to go to the ???



n-gram	count
send me	1547
send you	2353
send it	343
send hippo	1
...	
the end	13
the start	455
the bill	235
the cat	2534
the best	5646
...	

Newsire (272M words)

I agree spending under Bush was very bad, but Obama has been worse.

Can Zuma hold a nation together?

Like many of Ducasse's own intricate recipes, some require a fabulous amount of ingredients.

Five Victorian parks and squares in the Isle of Man are to be closed to the public in a bid to reduce vandalism.

Americans trying to impress Europeans!

If a firearm has been reproofed, it is a sign of previous wear.

One of the most popular couch surfing networks is CouchSurfing.com, where citizens of the world meet and arrange couch stays with other travelers.

NASA's spending problems are so predictable and big that two years ago Congress put it under the same tough budgeting rules as the Defense Department.

Now, replicas of old people, decrepit and toothless, move slowly about in motorised wheelchairs.

Wikipedia (1.4B words)

Co Co Wheats is made of wheat farina, cocoa, and additional flavorings.

The US built an aircraft where the jet exhaust drove the fans, while British projects not built included fans driven by mechanical drives from the jet engines. These trials involved military pilots from the United States, the United Kingdom and Canada.

What is confusing to me, Scribner, is that the details you want included are already there.

If you disagree, please consider taking it to AfD. Hello, I received the message about the Jaws Project page. The new page has been deleted so fast that I haven't had the time to reply and then there was no discussion.

If you can, please, could you copy and paste the old page in my talk page, so that I can give it a read?

Since they revert the article in teams, they do not trigger the blocking that this should receive. They simply do it, resulting in an inaccurate, defamatory entry. I showed above, in detail, the problem with their entry and with the external links they keep inserting.

Twitter (16.4B words)

Deep thinkers have the hardest time with relationships and religion.

Where's Stephen Curry at?

How can you tell someone you love them but let them go to bed crying?

How did I not know about car washes with neon lights? This is going on my list of nice sensory things in the world.

Only can buy in tradisional.

Impatiently waiting on Corey to get here!

This happening right now!

What other media does BRS has? I'm hearing people being disappointed at their favourite characters not getting much screen time.

I've been looking forward to this day for so long, can't believe it's already here!

His base would just love them! So sad there are so many of those idiots.

The Underground Taproom.

Training corpus	Words (M)	Example sentence
Yelp reviews	470	Wonderful customer service, always on time, and friendly!
Amazon reviews	3,997	I bought this camera specifically to take with me on a cruise.
Blog posts	599	After quickly inspecting her surroundings, her eyes snapped over to Sakon.
Project Gutenberg books	1,180	He tells some very interesting tales of early days in the West.
Apache email messages	167	Other parts can be released separately by people interested.
Web forum messages	278	This will give you a good guide on where you stand in your progression as a player.
Newswire	272	Can Zuma hold a nation together?
Movie subtitles	677	I managed to scrape up enough money to pay for him a ticket.
Social media updates	829	For all my wrestling family, must read story.
Reddit messages	70,318	I'm trying to think of what to make everyone.
Twitter	16,396	Impatiently waiting on Corey to get here!
Common crawl web text	184,647	Some of the organisers have also been Finnish citizens.
Wikipedia	1,462	What is confusing to me, Scribner, is that the details you want included are already there.
Usenet posts	1,615	Two hours later I get another call.

Better AAC-like data?

She is my best friend.

Why do you say that so?

Gimme a minute.

This should not to happen to anyone in the world.

Check out the news online today.

Please let this work!

Please take me with you.

Get Betty to ER.

How can I help you?

Why did I have to lose my ability to speak and write?

Get me some painkillers!

I hope you feel better soon.

When will I get back to normal?

I don't know, let me ask her.

Thank you for helping me.

Please change my bandages, they are starting to itch.

How was work today?

Let's go shopping.

It's hard to think positive.

Hai I'm inviting you for my anniversary.

Won't you be late for your class?

Paid crowdsourcing

amazonmechanical turk
Artificial Intelligence

text

Your Account

HITs

Qualifications

Introduction | Dashboard | Status | Account Settings

Mechanical Turk is a marketplace for work.

We give businesses and developers access to an on-demand, scalable workforce. Workers select from thousands of tasks and work whenever it's convenient.

417,411 HITs available. [View them now.](#)

Make Money
by working on HITs

Get Results
from Mechanical Turk Workers

CrowdFlower

Why CrowdFlower?

Products

Solutions

Customers

About

Blog

The world's **largest** enterprise
crowdsourcing platform.

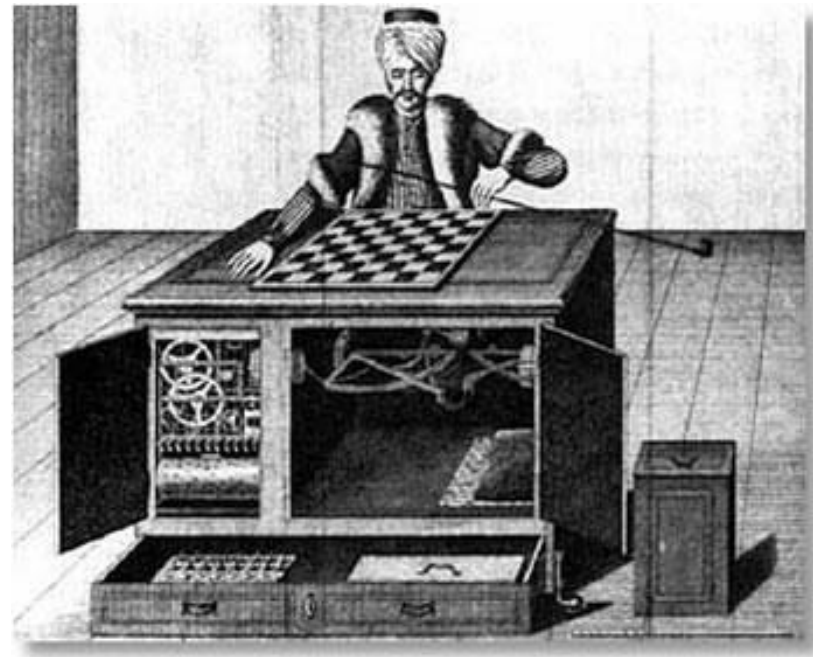
With access to more than 1.5 Million Contributors worldwide, our technology platform offers quality-assured crowdsourcing at unprecedented scale.

PICK A SOLUTION



Amazon Mechanical Turk

- **Human Intelligence Task (HIT)**
 - Workers and requestors
 - Web-based
 - HTML + JavaScript if hosted entirely on MTurk
 - Price per HIT
 - # of workers per HIT
 - Qualifications for workers
 - Accept/reject work



<http://www.behind-the-enemy-lines.com/2010/03/new-demographics-of-mechanical-turk.html>

http://waxy.org/2008/11/the_faces_of_mechanical_turk/

Our first Amazon HIT

Due to a medical condition or accident, **imagine you can't talk or type** on a normal keyboard. Instead, you use a special **communication device that speaks for you**. You operate this device by pushing a button whenever your desired letter is highlighted. By repeatedly pushing the button, you can spell out words, phrases or entire sentences.

Invent a fictitious (but plausible) communication you might make using your device. Think of the things you might want to say to your family, friends, caregivers, and people you meet in the community. Please proceed **quickly and accurately**. Do NOT include any private information (such as real email addresses, phone numbers, or names). **Invent a new communication** for each task of this type.

Write as if you were actually using your communication device to speak for you. Do NOT write about your actions or state of mind.

Another Amazon HIT

Situation 1/10

For the given communication situation, write two sentences. One sentence will be in the form of a statement (giving information or opinion) and the other will be in the form of a question. As best you can, **reproduce utterances you have recently used in a similar communication situation**. If this is not possible, make up a sentence you might likely use in the given situation.

Do NOT include any private information (such as real email addresses, phone numbers, or names).
Do NOT cut and paste (we will reject work done in this way).
Do NOT use texting abbreviations or slang.
Please write **complete sentences with good grammar and spelling**.

Communication situation: **Talking to your mother.**

With respect to the above communication situation, write a sentence in the form of a **statement** (giving information or opinion):

☐ I have actually used this statement ☐ I might use this statement in the future

With respect to the communication situation, write a sentence in the form of a **question**:

☐ I have actually used this question ☐ I might use this question in the future

Continue >>

Examples of invented communications

I started sewing and I'm proud of myself.

Where would you like to go eat for mother's day?

What will be on the test next week?

Are there any more in stock?

I am very proud of how well you are doing right now.

It is hard to believe that people actually do the things these magazines and tabloids say they do!

May I borrow your red wrap dress for an evening function tonight?

When did this happen?

Do you want me to pick up some food to take over there?

Hello, David, how have you been?

No I wouldn't like anything, thank you!

The light switch in my hallway is broken.

Bro do you have a dollar I can borrow?

What do you think?

Work is going very well.

I hope the test today isn't too hard.

He is so funny and cute.

How's it going?

When are you coming back to pick up the baby?

Thank you for your assistance.

Onscreen keyboard HIT

You will be shown two sets of 10 phrases. You need to **enter each phrase using an onscreen keyboard**. For one set of phrases, you will be able to see the phrase while typing it. For the other set of phrases, the phrase will disappear once you hit START. For this set, you need to **read it and try to remember it. DO NOT write anything down**. It is okay if you can't remember the whole thing, just type as much as you can remember.

You type the phrase by clicking on the buttons on the keyboard shown below. There is a **backspace key** in the upper-right. To enter uppercase letters, press the **shift key** in the lower-left. There are four **double width spacebar keys**, you can enter spaces using any of them. Please proceed **quickly and accurately**.

Phrase 2/20:

the dirtiest of internal



START

The phrase will disappear when you press START

After accepting the HIT, click the "START" button to the right of the keyboard to start writing the first phrase. After finishing a phrase, click the "DONE" button to move to the next phrase. Once all phrases are complete, click the "SUBMIT" button below.

Workshop details

- **Goal: Crowdsourcing conversational text**
 - Approximate what AAC users might want to say in everyday conversations
 - What topics / situations do you think are missing or underrepresented in existing data?
- **Group tasks:**
 - Brainstorm ideas for what to collect
 - Modify existing HTML / JavaScript page to do it
 - Test on Amazon Mechanical Turk sandbox
 - Deploy for real on Amazon, wait 1-2 hours
 - Analyze collected data