

A SCHOOL-UNIVERSITY-STARTUP PARTNERSHIP: LEARNING & TEACHING WITH AAC AND ITS GROUNDBREAKING EVOLUTION WITH EEG

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Background



➤ InnoHK

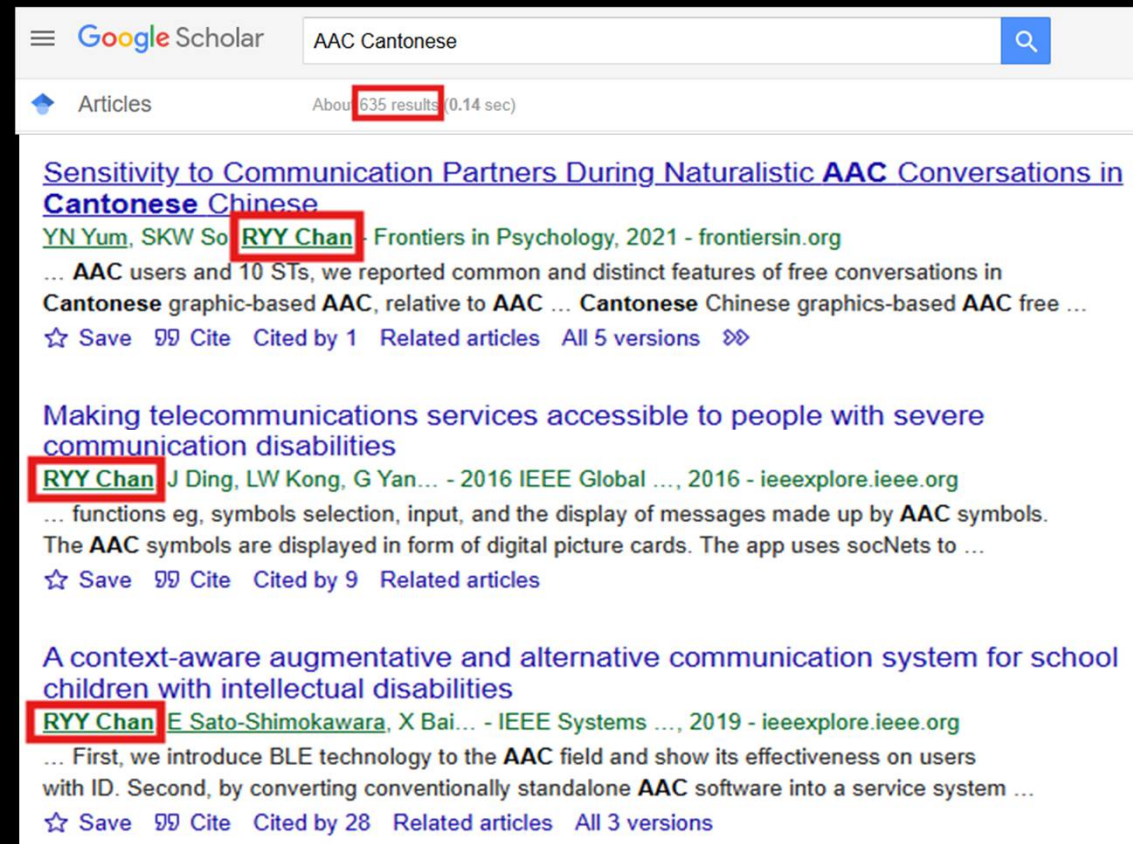
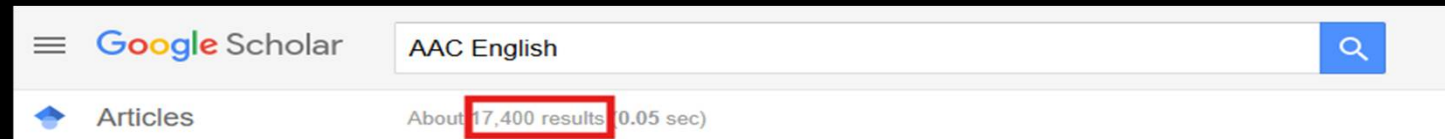
- Hong Kong Government's initiative to turn innovation into tangible impact through world-class research collaboration
- 30 Research Laboratories | 3000+ Researchers | 12 Economies | 30+ Non-Local Institutions

➤ Centre for Perceptual and Interactive Intelligence (CPPI)

- Vision: To realize the promise of AI and achieve transformative benefits for society.
- Mission: Targeting the sectors of healthcare, urban services and reindustrialization, CPPI is running research programmes covering Visual Intelligence as well as Speech & Language Intelligence.

Gaps in the market

- Limited support in Cantonese



Gaps in the market

- AAC prediction training data lacks AAC patterns

“My phone is about to die: do you have a charger I could borrow?”

VS

“phone dead. Charger?”

Predictive text is largely based on models trained on language from non-AAC users. For that reason, **an AAC user's communication style may not be well reflected in predictive text**. A user may, for example, use shorter phrases or shortcuts with spelling that aren't included in predictive-text options. 15 Mar 2025



American Speech-Language-Hearing Association | ASHA

<https://on.asha.org/pred-text>

Predictive Text: Who Controls the Conversation? - ASHA

Co-Design Partner

Mary Rose School



- Founded in 1970
- School for children with mild & moderate intellectual disability
- Emphasizes comprehensive whole-person education with flexible, differentiated instruction
- Collaborative teaching & student-centered design of materials

Co-Design Partner

Red Cross Margaret Trench School

- Founded in 1973 by Hong Kong Red Cross
- ~95 students with physical disabilities
- Holistic education based on Red Cross humanitarian principles: Rehabilitation, Wisdom, Perseverance, Community
- Cross-disciplinary team approach: Teachers + Speech/OT/PT Therapists + Social Workers + Nurses



School-University-Startup Partnership

- Our multi-stakeholder collaboration:
 - **Special Schools:** Direct student needs & classroom integration (Mary Rose School, Hong Kong Red Cross Margaret Trench School)
 - **University:** Research & advanced AAC system design (CUHK Centre for Perceptual and Interactive Intelligence)
 - **Startup (spinoff from CPII):** Sustainable technology innovation & deployment (SENsAI)
- Result: 12+ months of co-design with educators, therapists, and students

Cloud based AAC

- Does not rely on a single device. The entire system is cloud-based.

Smart AAC Book

Centralized admin console

- Adding/modifying graphics to stand-alone/offline AAC apps:
 - Open Device 1 -> Add/Modify graphics -> Test
 - Keep repeating for 'n students * m devices



Centralized admin console

- Login as an admin, Add/Modify graphics
- Done!

Cards Admin Console Card CardSet User Group Record Analytics ▾ Admin Log Out

Create CardSet

Homepage ▾ Add Phase Delete Last Phase

Add cards

Source : All ▾ Category : All ▾

人物_學校 助教 司機 書記 同學 校工 物理治療師 社工 職業治療師 言語治療師	ADD
--	-----

Remove cards

Source : ▾ Category : ▾

	REMOVE
--	--------

Change Order

▾ 6x4 ▾

PREV

Viewable

Groups Available		Groups Chosen		Users Chosen		Users Not Viewable
All Users All Groups Selected Users Group	<=>				<=>	

Review

View Demo

CardSet Title

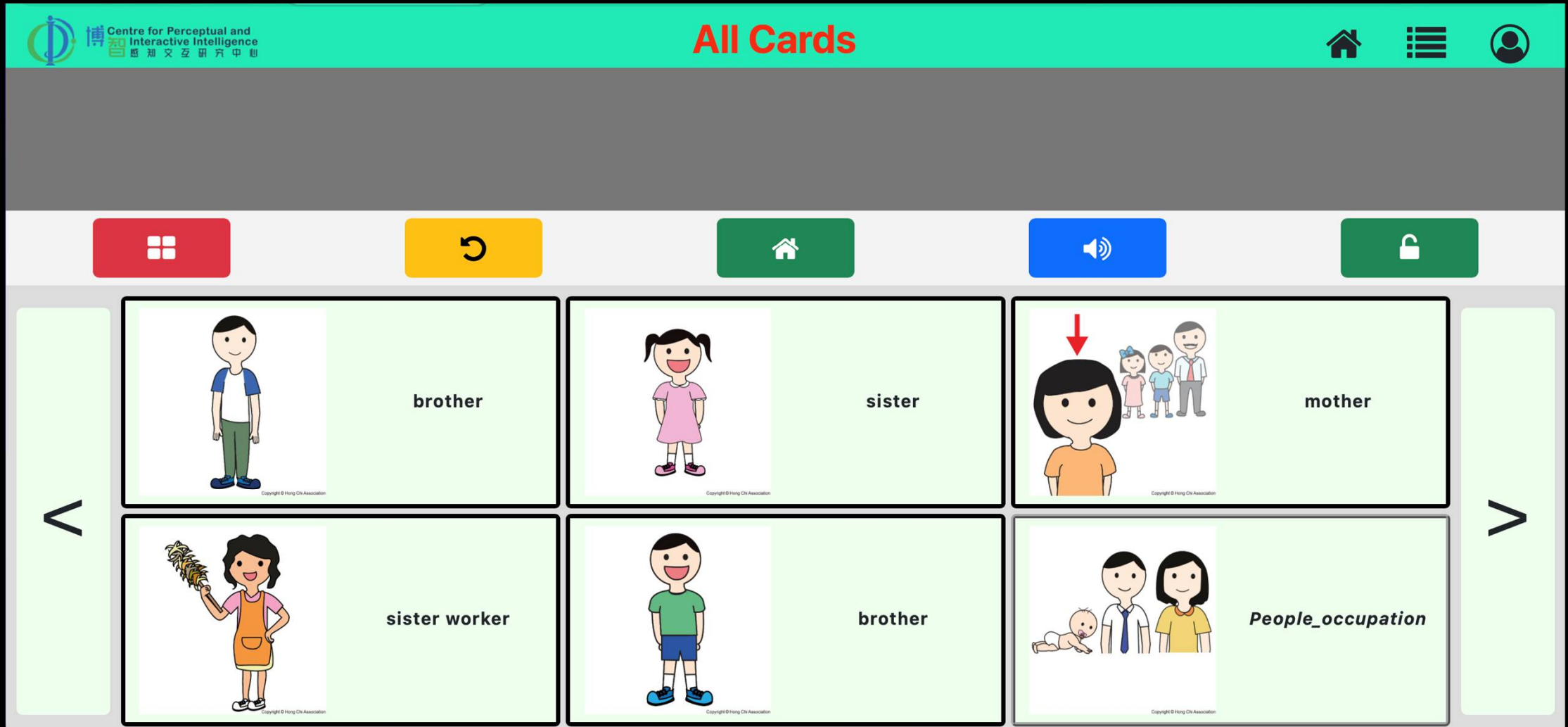
Homepage ▾

No Viewable Group/User

CREATE

Prefixes

- Admin can change the default “prefixes”



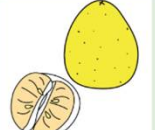
Prediction

➤ graphics prediction after "eat".

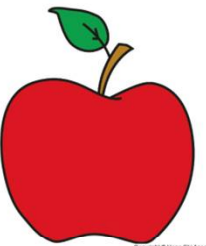
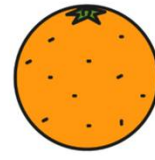
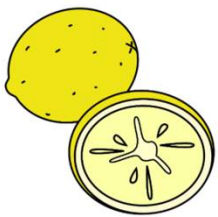
 博智 Centre for Perceptual and Interactive Intelligence
感知交互研究中心

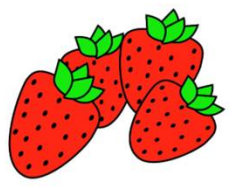
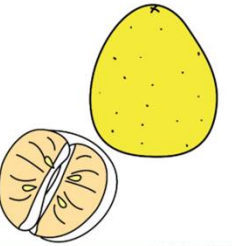
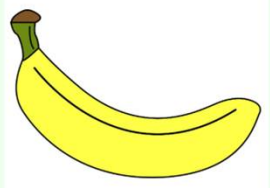
All Cards

 sister  eat  grapefruit

 apple  orange  lemon

 strawberry  grapefruit  banana

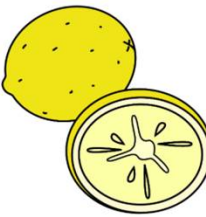
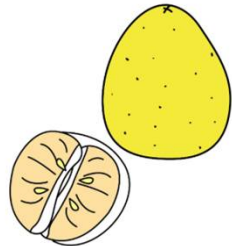
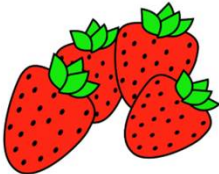
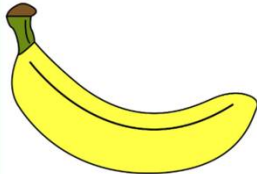
Prediction

- The position of "grapefruit" goes up this time.

 **All Cards**   

 sister  eat

 apple	 orange	 lemon
 grapefruit	 strawberry	 banana

< >

Multiple admin

- Different setting requires different admin
- Different admin may have different authorization & preference.

AAC Book Console

Card

CardSet

User

Group

Record

Analytics ▾

Admin

Log Out

Admin

Show 10 ▾ entries

Search:

Teacher	Yes
Parent	No

For classrooms: identical graphics

- Same graphics for all students: teachers can teach without confusion
- Everyone included, no student feels different



For home: personalization

- Every home is unique. Members/contexts/objects/routines all different = different vocabulary
- Real photos = personal connection

HCAAC_13

Display Text

妹妹

En

sister

Image

No file chosen



Copyright © Hong Chi Association

Category

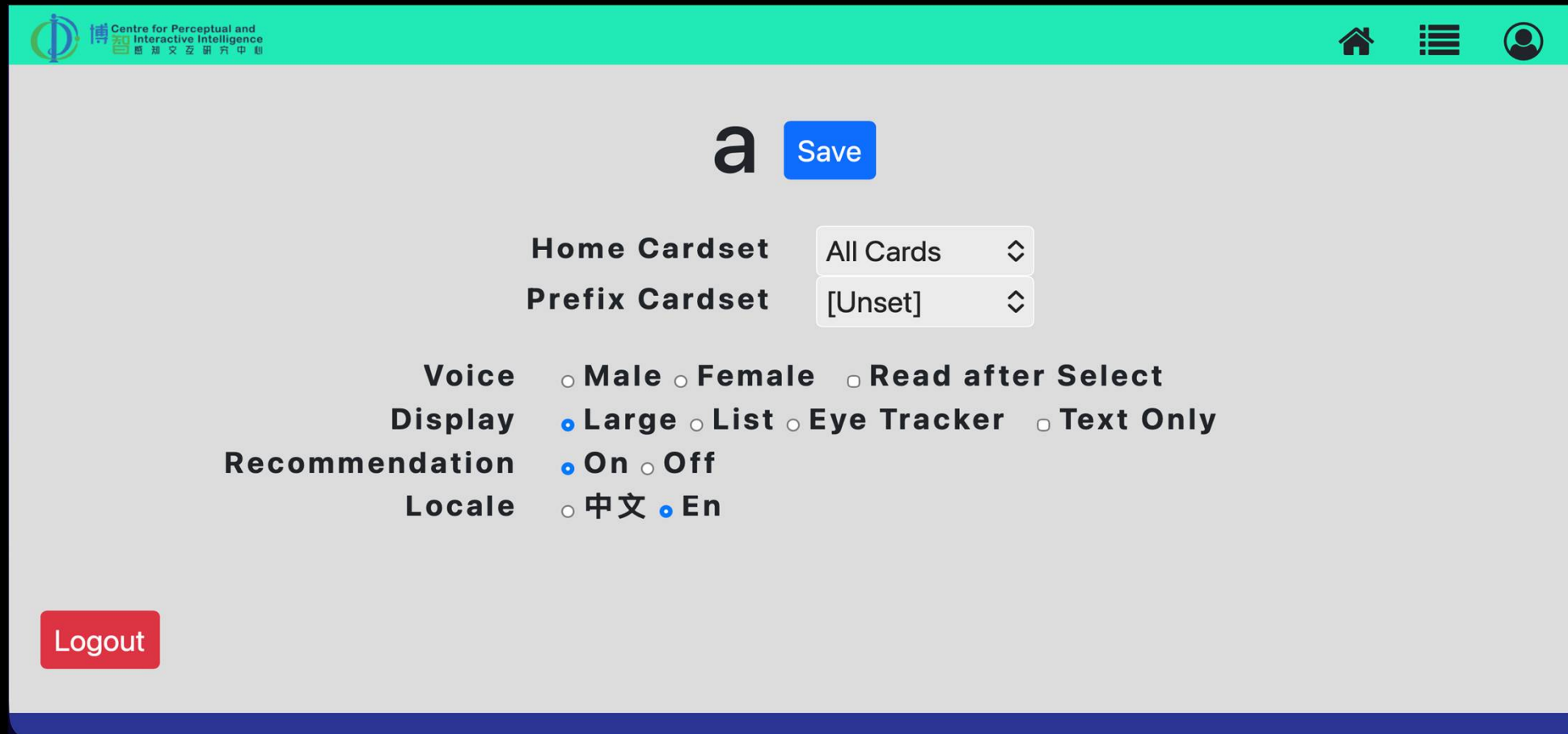
人物_家庭 ▼

Level

1

customization

- Choose "Eye-tracker" display mode



The screenshot shows a web-based customization interface. At the top is a teal header bar with the Centre for Perceptual and Interactive Intelligence logo on the left and navigation icons (home, menu, user) on the right. The main content area has a light gray background. At the top center is a large lowercase letter 'a' followed by a blue 'Save' button. Below this are two dropdown menus: 'Home Cardset' with 'All Cards' selected and 'Prefix Cardset' with '[Unset]' selected. Further down are four rows of settings, each with a label and a series of radio button options: 'Voice' with 'Male', 'Female', and 'Read after Select'; 'Display' with 'Large' (selected), 'List', 'Eye Tracker', and 'Text Only'; 'Recommendation' with 'On' (selected) and 'Off'; and 'Locale' with '中文' and 'En' (selected). A red 'Logout' button is located in the bottom left corner.

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Home Cardset All Cards

Prefix Cardset [Unset]

Voice ☐ Male ☐ Female ☐ Read after Select

Display ☒ Large ☐ List ☐ Eye Tracker ☐ Text Only

Recommendation ☒ On ☐ Off

Locale ☐ 中文 ☒ En

Logout

Eye-tracker

- Large pictures display for eye-tracker usage.



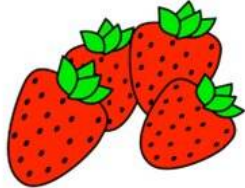
Performance analytics

- Analyse the time spent on tasks.

Username : d

Cardset : My Cards

Datetime : 2025-11-27 15:17:52

Time Per Card	Start	1.22 s	1.102 s	0.887 s
				
	我	鍾意	食	士多啤梨
Total Time	2.986 s	4.206 s	5.308 s	6.195 s

Time to submit after finish : 1.190 s

Sentence Length : 4

Average Time per card : 1.549 s

FEEDBACK FROM TEACHERS & SCHOOLS

- **Flexible for different learners (physical and/or cognitive abilities)**
- **More accessible input methods like eye-tracking and switch**
- **Teachers and therapists welcome the system**
- **Accessible for outdoor activities with iPads/notebooks with wireless network**

Next chapter: EEG

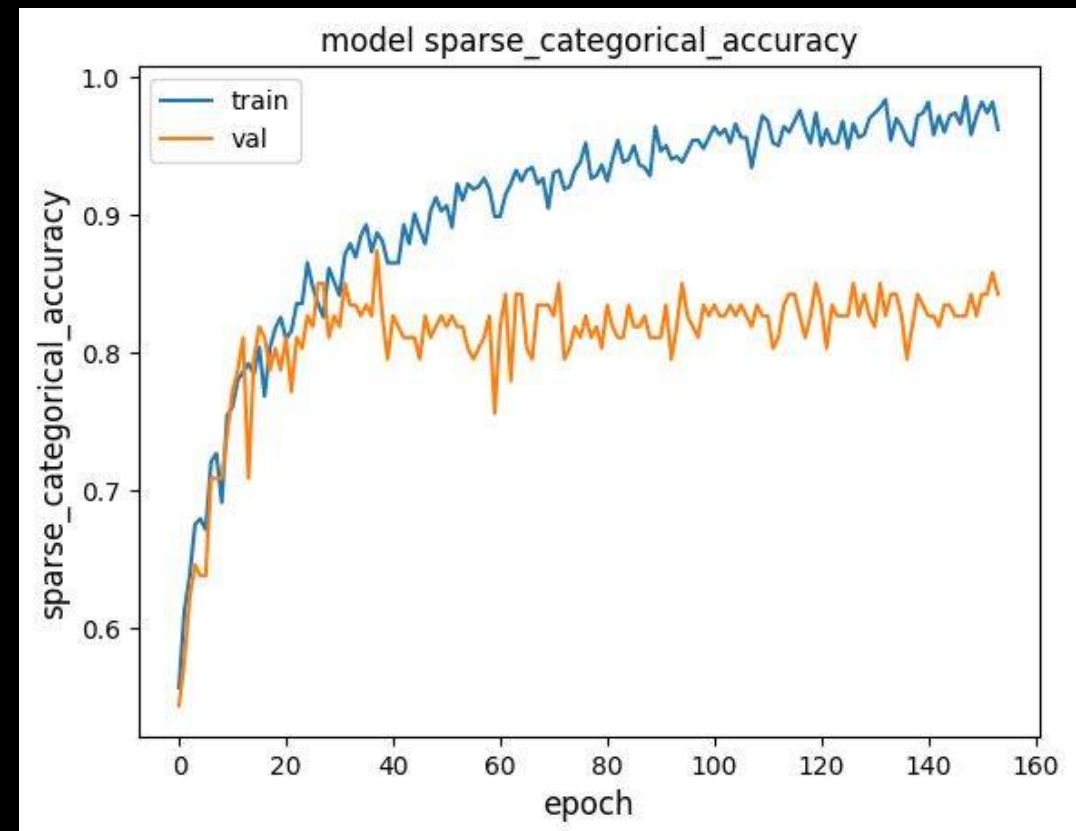
Our AAC system works for “most” people

VS

Our AAC system works for “all” people

Research grade device

- Extremely expensive, not feasible for average students/patient
- Wet electrode: requires gel application, expertise required.
- Uncomfortable for extended usage.



Consumer grade device

- Less number of EEG channels, data are much noisier
- Relatively affordable.
- Dry electrodes, no gel application on scalp.



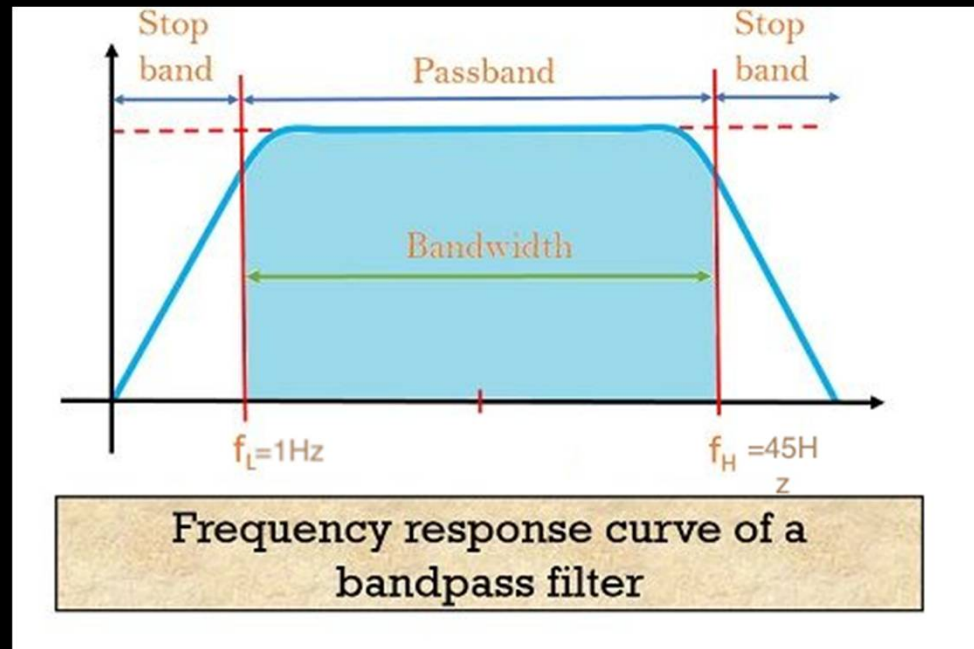
Bandpass filtering

➤ Why filter < 1 Hz ?

- Electrode movement
- Physiological signals (like respiration)

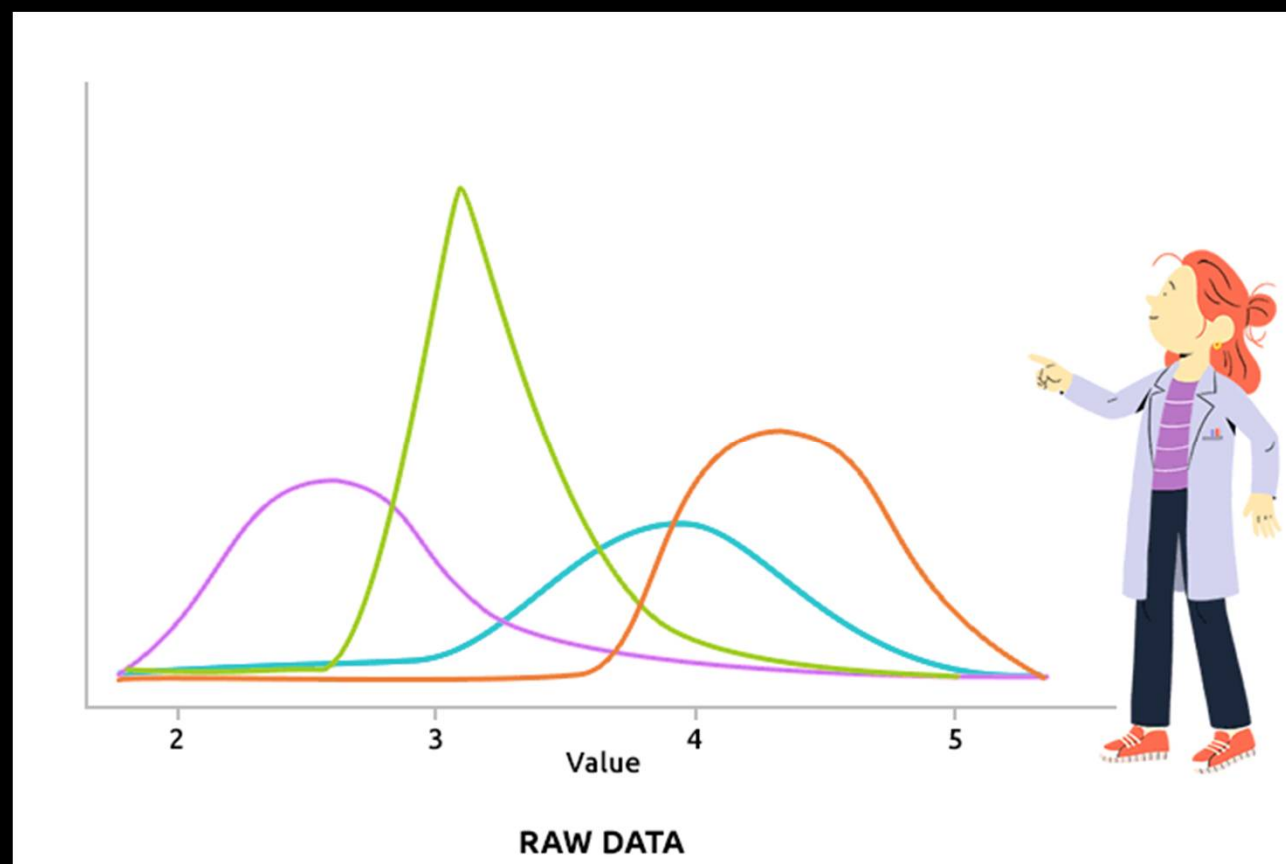
➤ Why filter > 45 Hz ?

- Muscle activity (Jaw contraction)
- Electrical power from EEG device



Normalization

- Removes noise-dominating patterns
- Makes all channels comparable scale

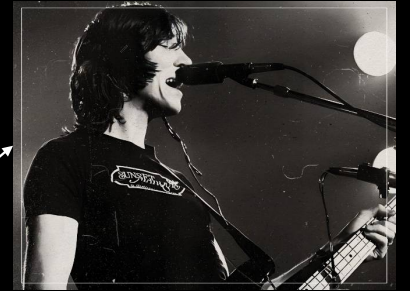


Independent component analysis

- Imagine isolating the vocal, the guitar and the drums of your favourite song from each other



ICA

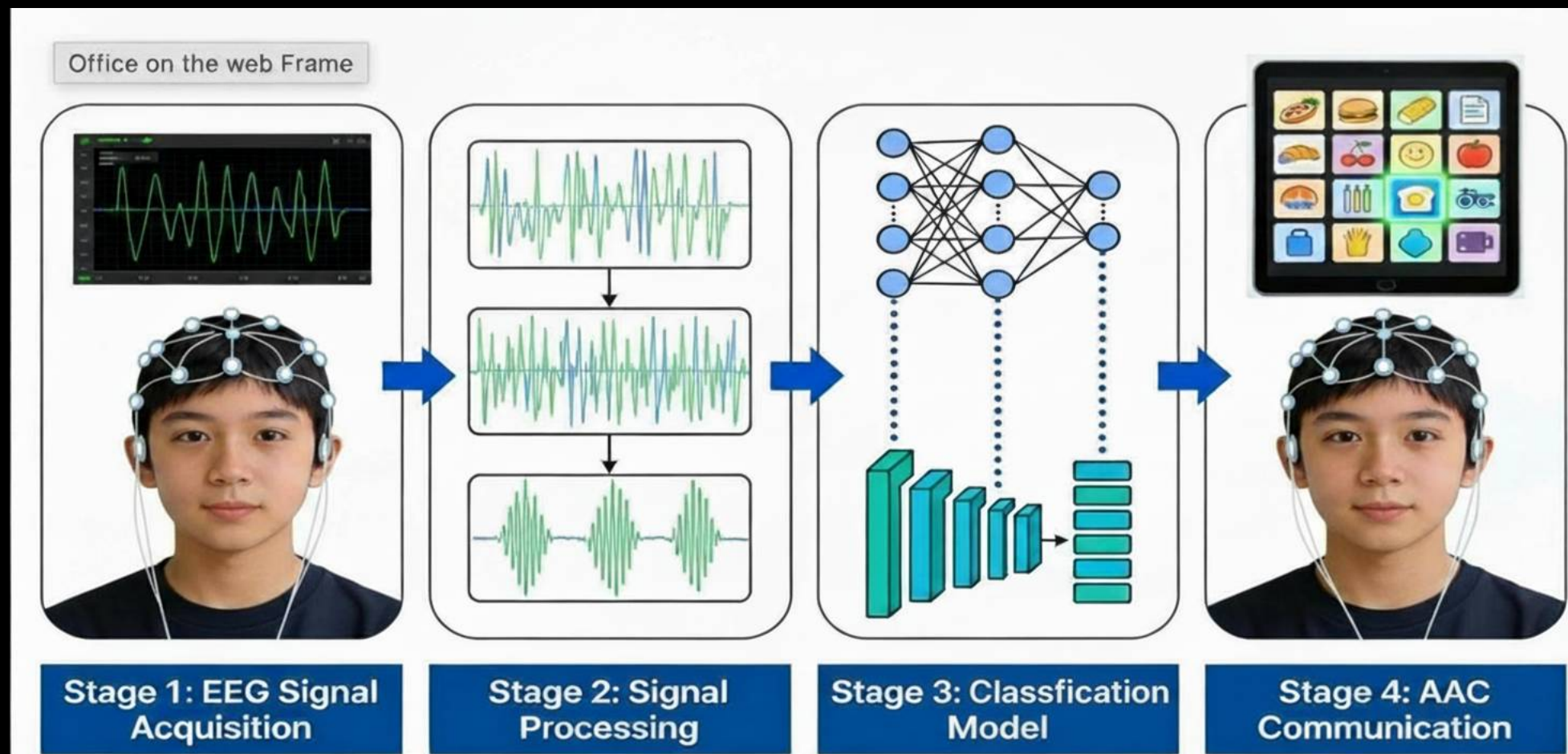


Independent component analysis

- Separates mixed EEG signals into independent brain components



Towards an EEG-based AAC System



From Research & Development to School Applications



Thank you very much!

Acknowledgement



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