



Write Out Loud

**A multi-modal way to learn
Chinese characters and more**

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Final Presentation

Traditionally...

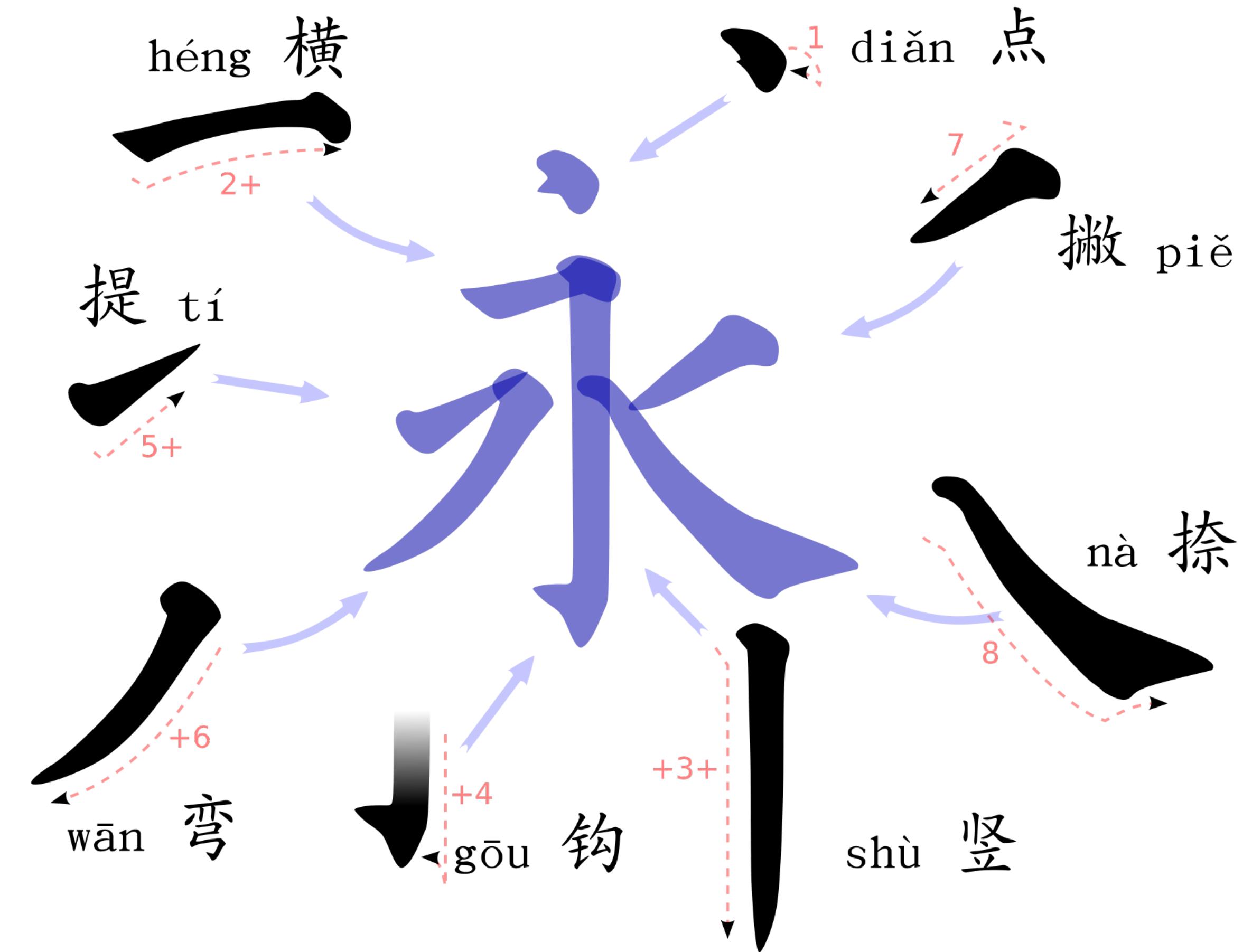
Writing Chinese characters
is learnt in silence



Yet...

Learning a new character is multi-modal

- Its pronunciation(s)
 - How does it **sound**
 - How to romanize it (pinyin, etc)
- Its shape, decomposed into
 - Different strokes
 - In a **particular stroke order**



Source: https://commons.wikimedia.org/wiki/Commons:Stroke_Order_Project/Kangxi_radicals#/media/File:8_strokes_of_%E6%BO%B8-zh.svg



Guide a Chinese learner to
vocalize each stroke
while **writing** a character

“Multisensory Learning”

Demo



Show Real-time Transcript **Characters Selection****口****人****日**

kǒu - mouth

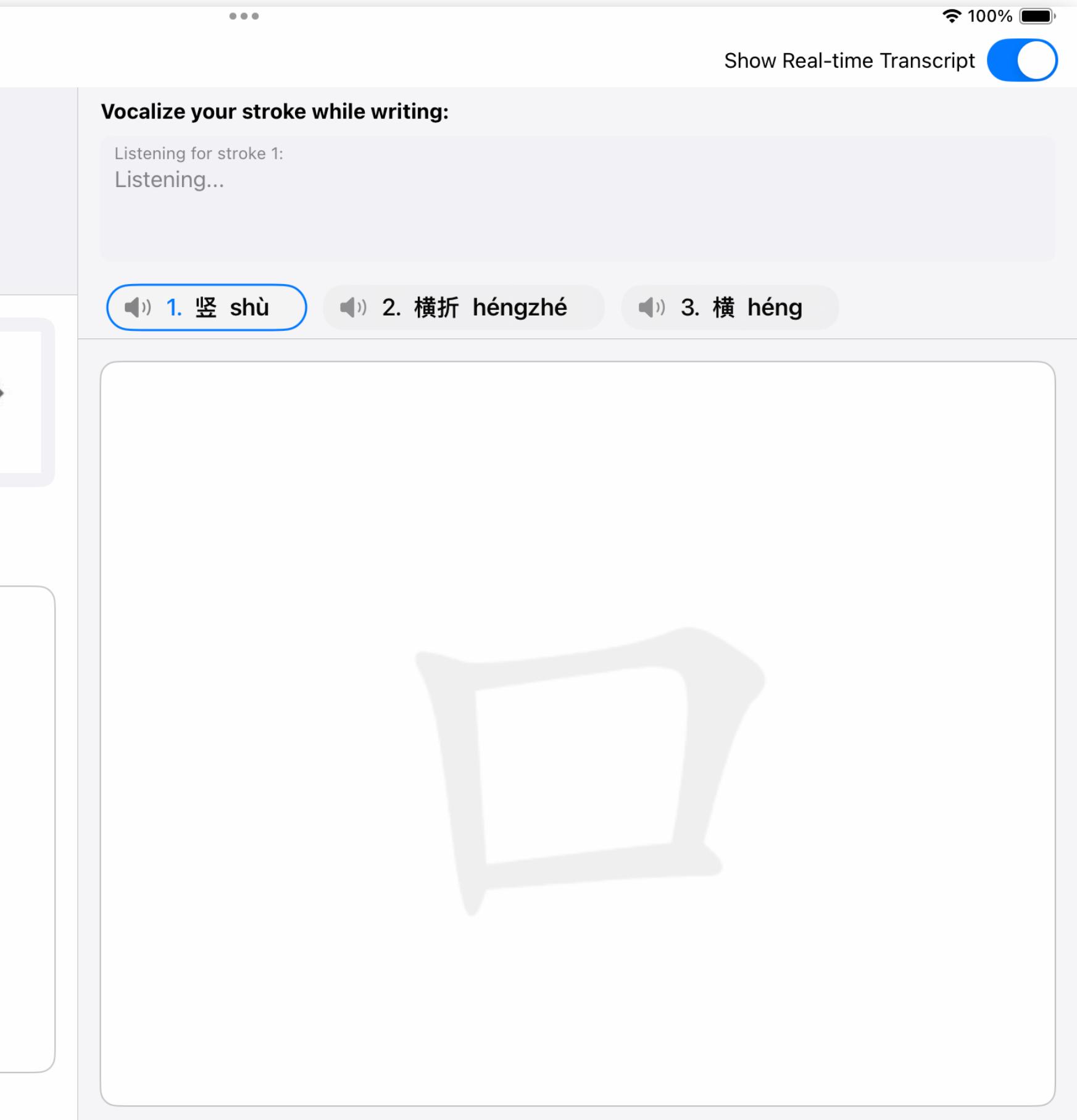
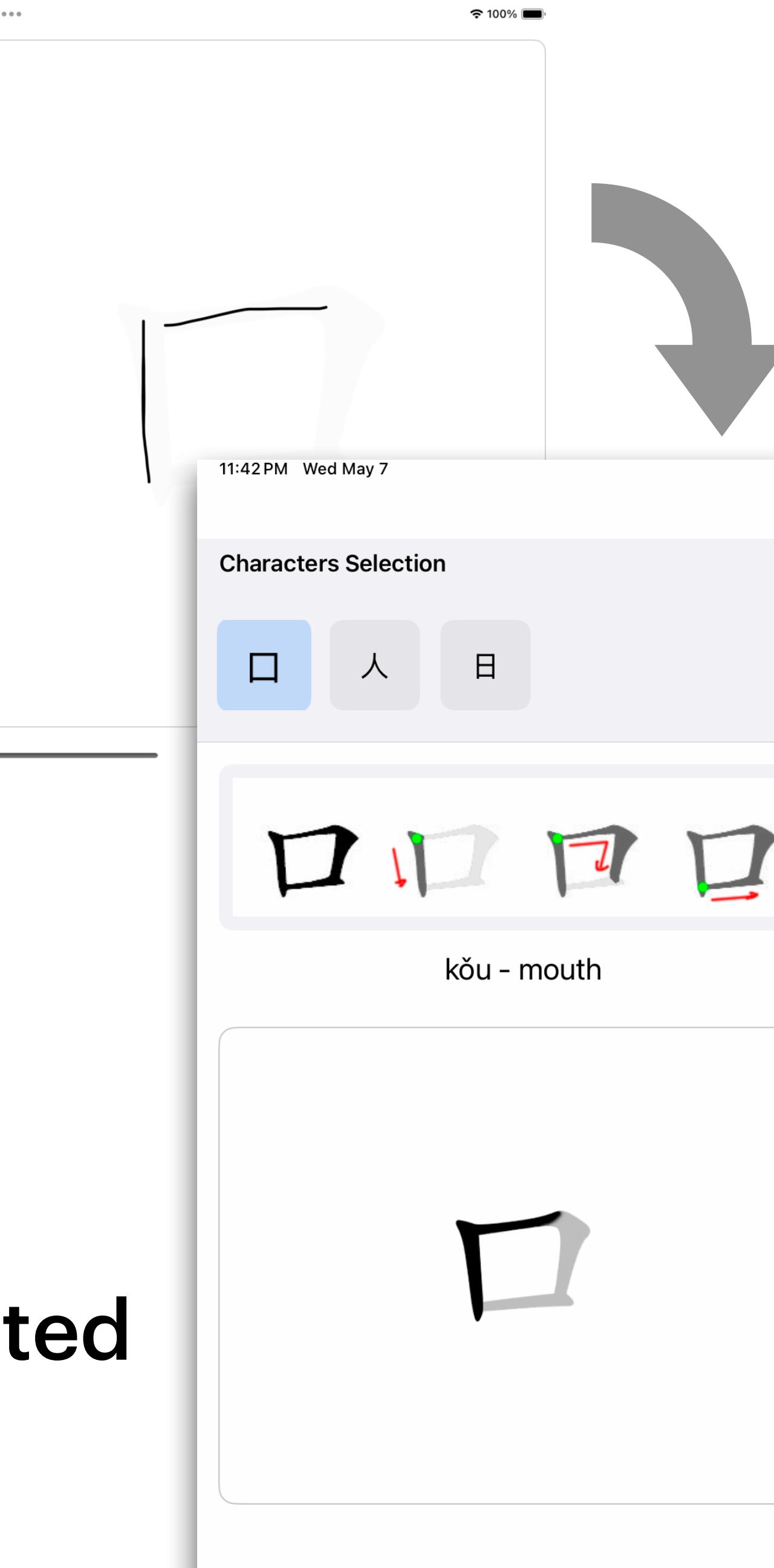
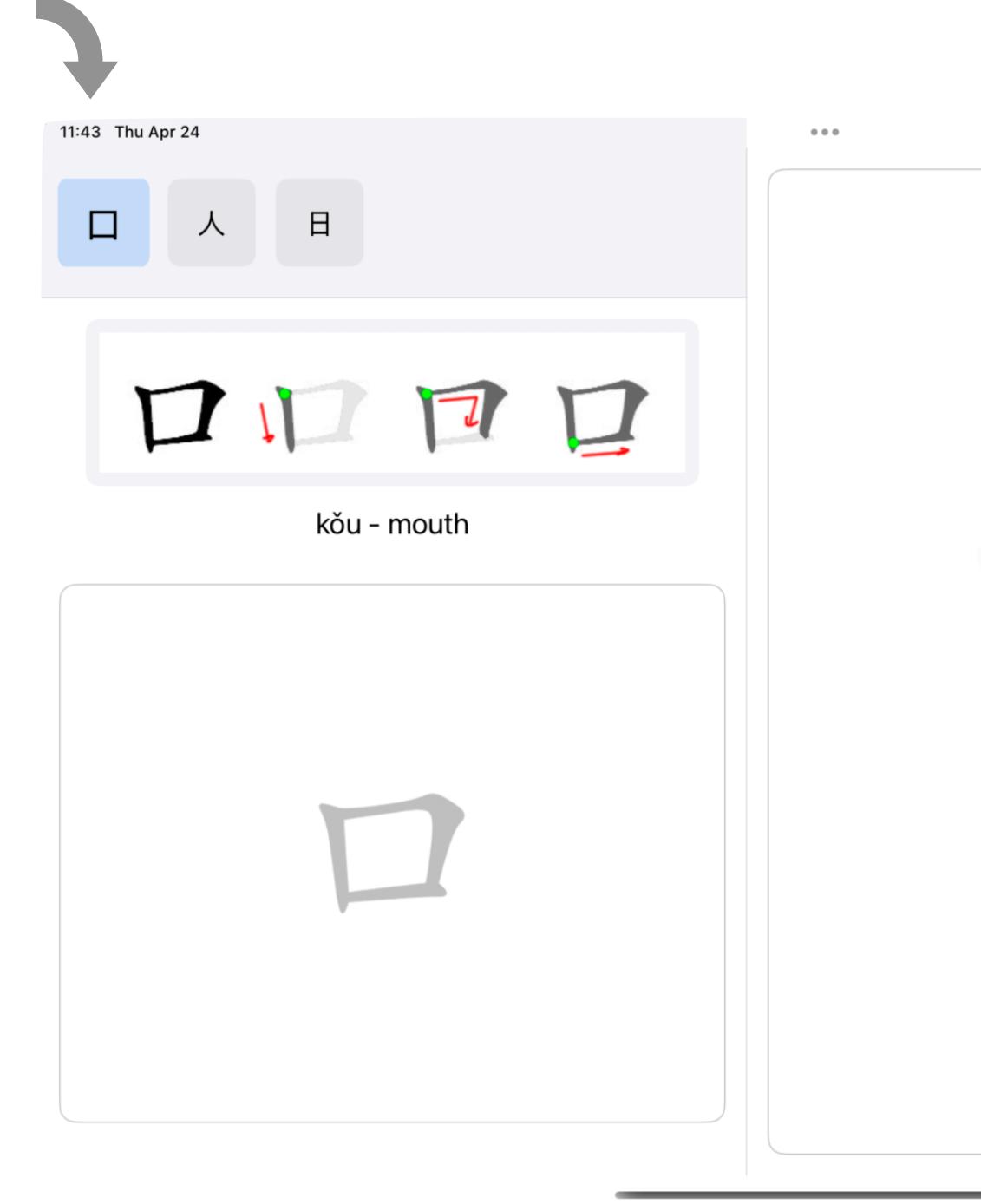
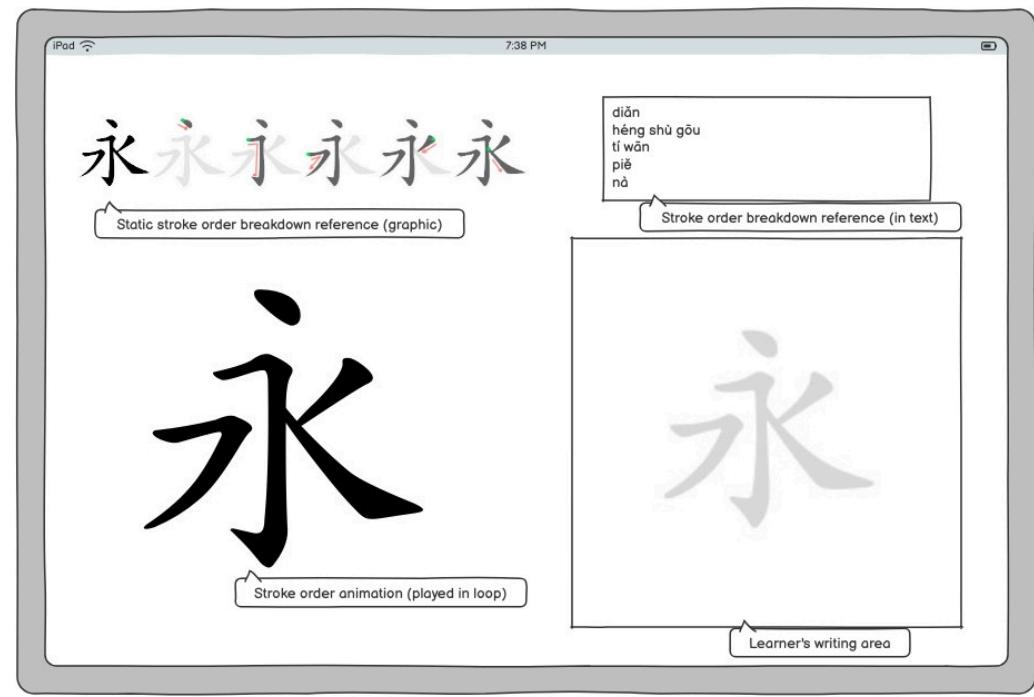
**Vocalize your stroke while writing:**

Listening for stroke 1:

Listening...

1. 竖 shù**2. 横折 héngzhé****3. 横 héng**

Updates

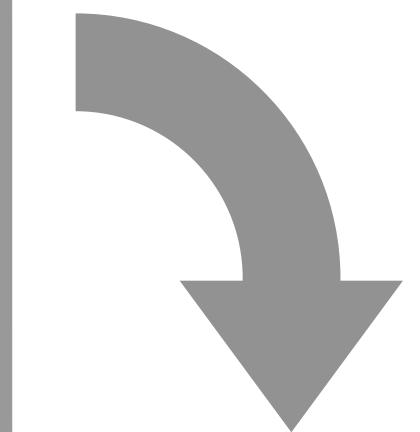
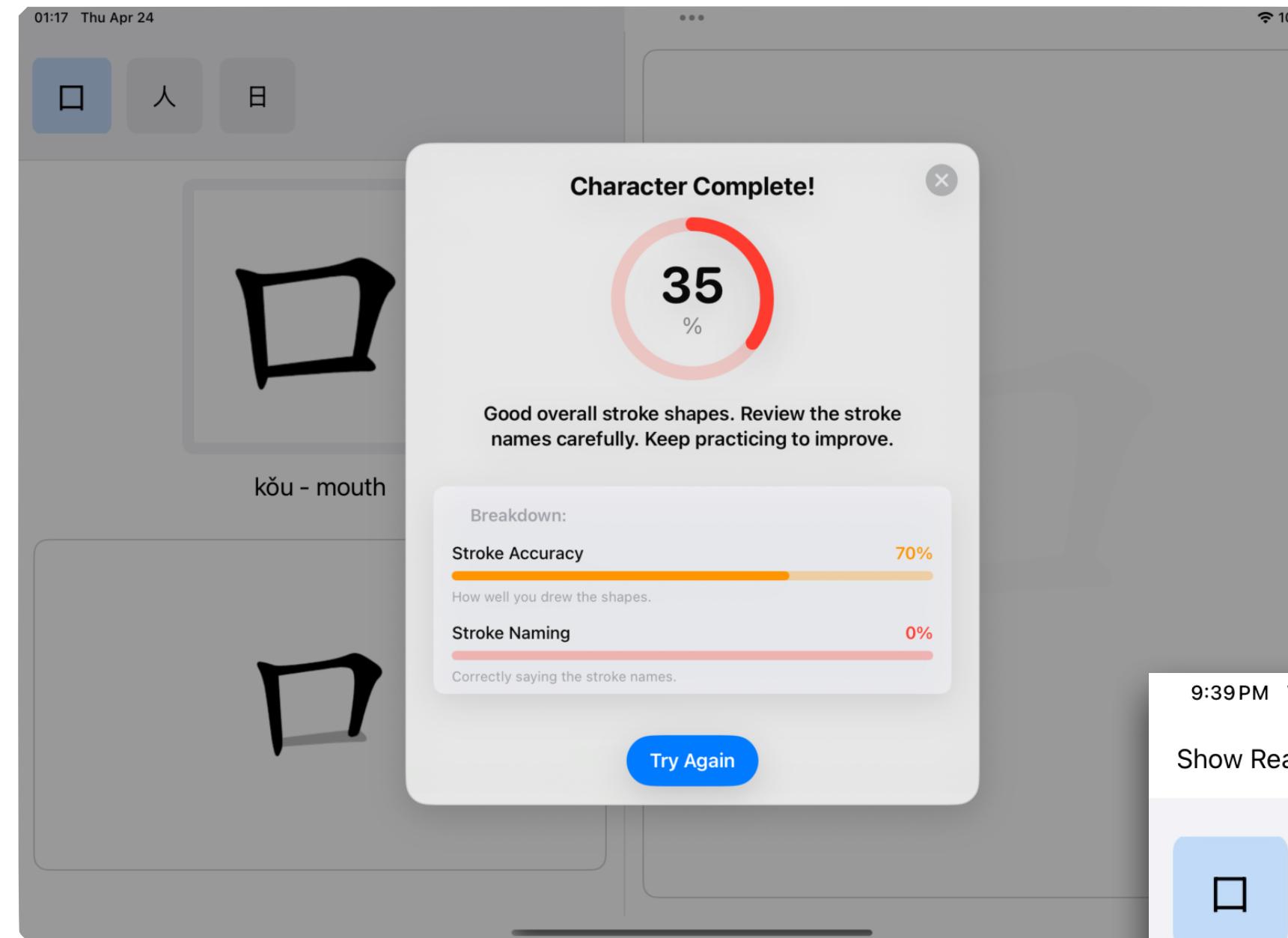


Enriched Layout

Just enough info to get started

Simple Feedback

Correctness visualized on the spot

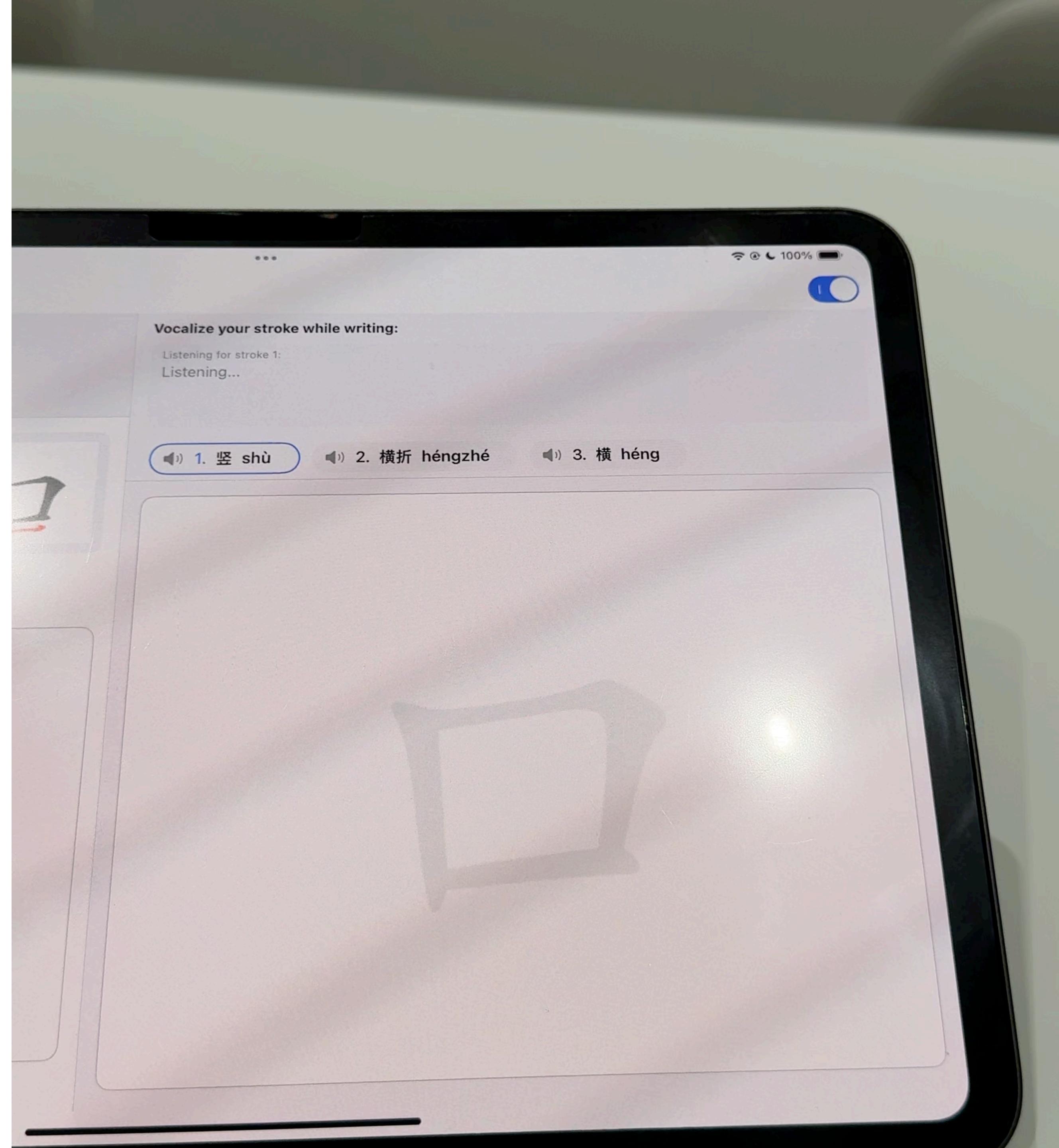


A screenshot of a mobile application interface for practicing Chinese characters. At the top, there are three buttons labeled '口', '人', and '日'. Below them is a large square input field containing the character '口' (mouth). To the right of the input field is a 'Show Real-time Transcript' section. It displays four versions of the character '口': the original, a grey outline, and two versions with red stroke outlines. Below this is a 'kǒu - mouth' label. In the bottom right corner of the screen, there is a large red curved line. To the left of the red line, there is a green vertical stroke and a green horizontal stroke. On the far right, there is a list of spoken strokes with corresponding expected strokes and speech detection status:

- 1. Expected: 竖 shù No speech detected
- 2. 橫折 héngzhé ✓
- 3. 橫 héng ✓

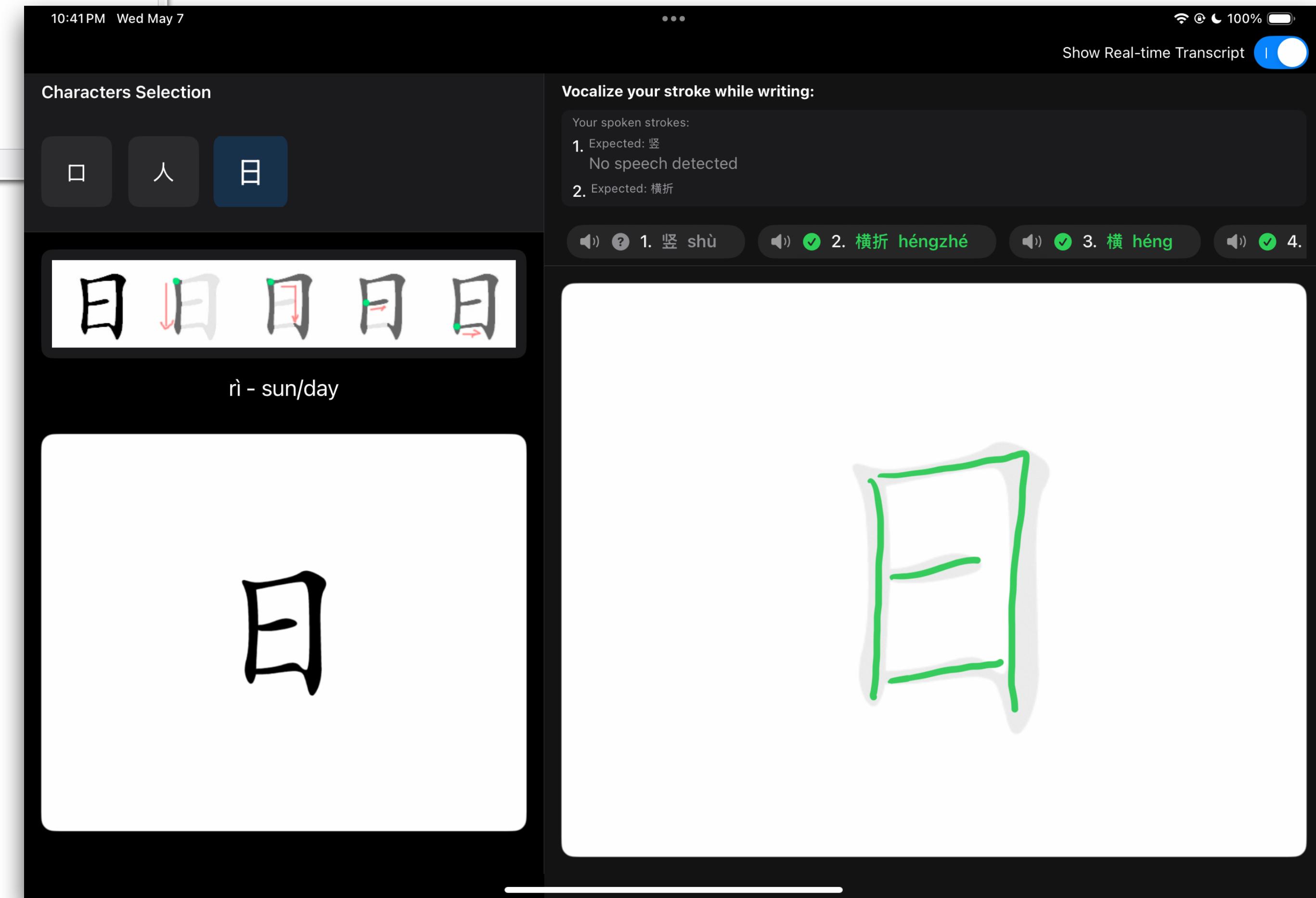
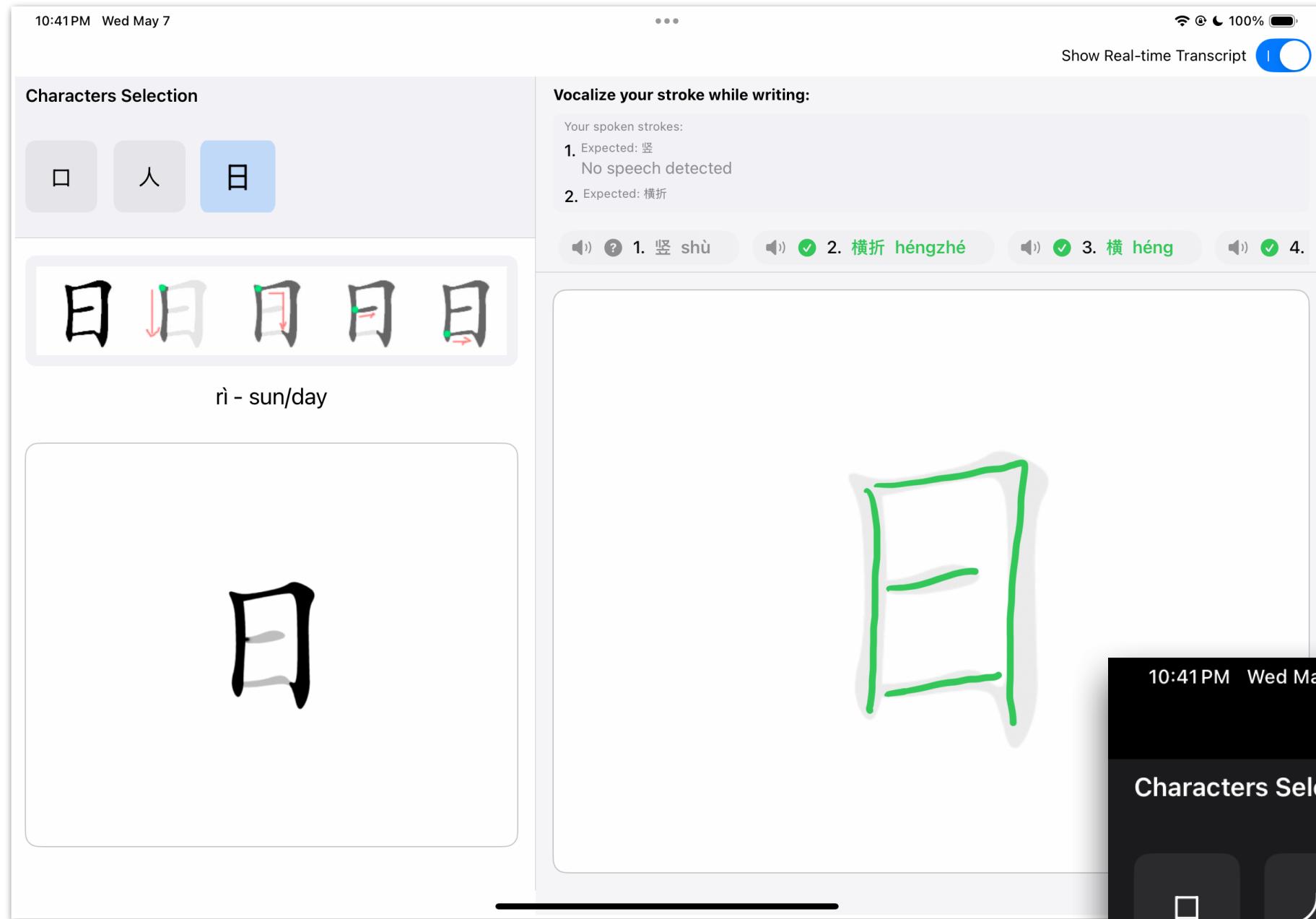
New: Stroke Name Example

Made possible by
Apple's native (robotic) Text-to-Speech 🤖



Dark Mode

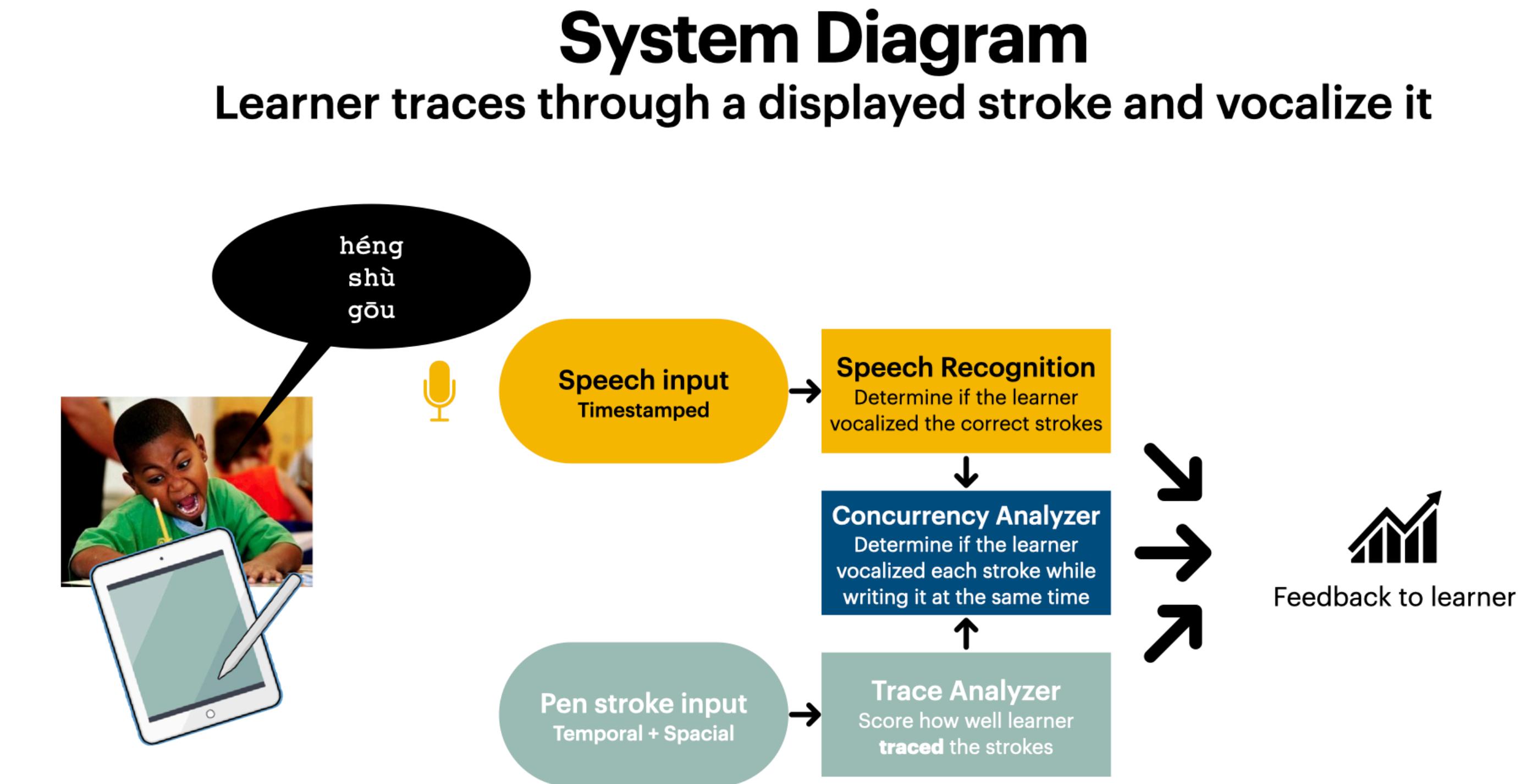
Because why not...



How it works

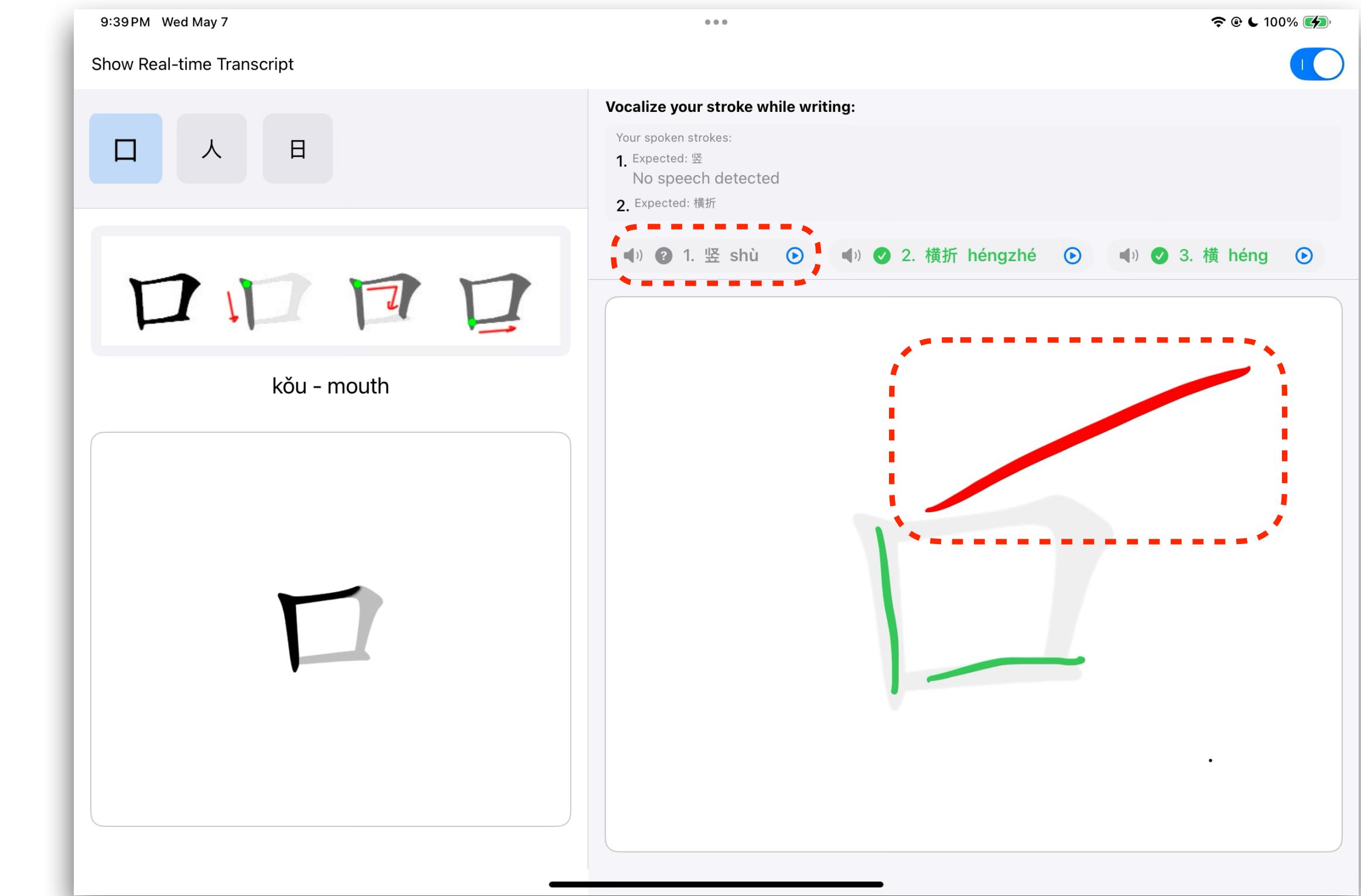
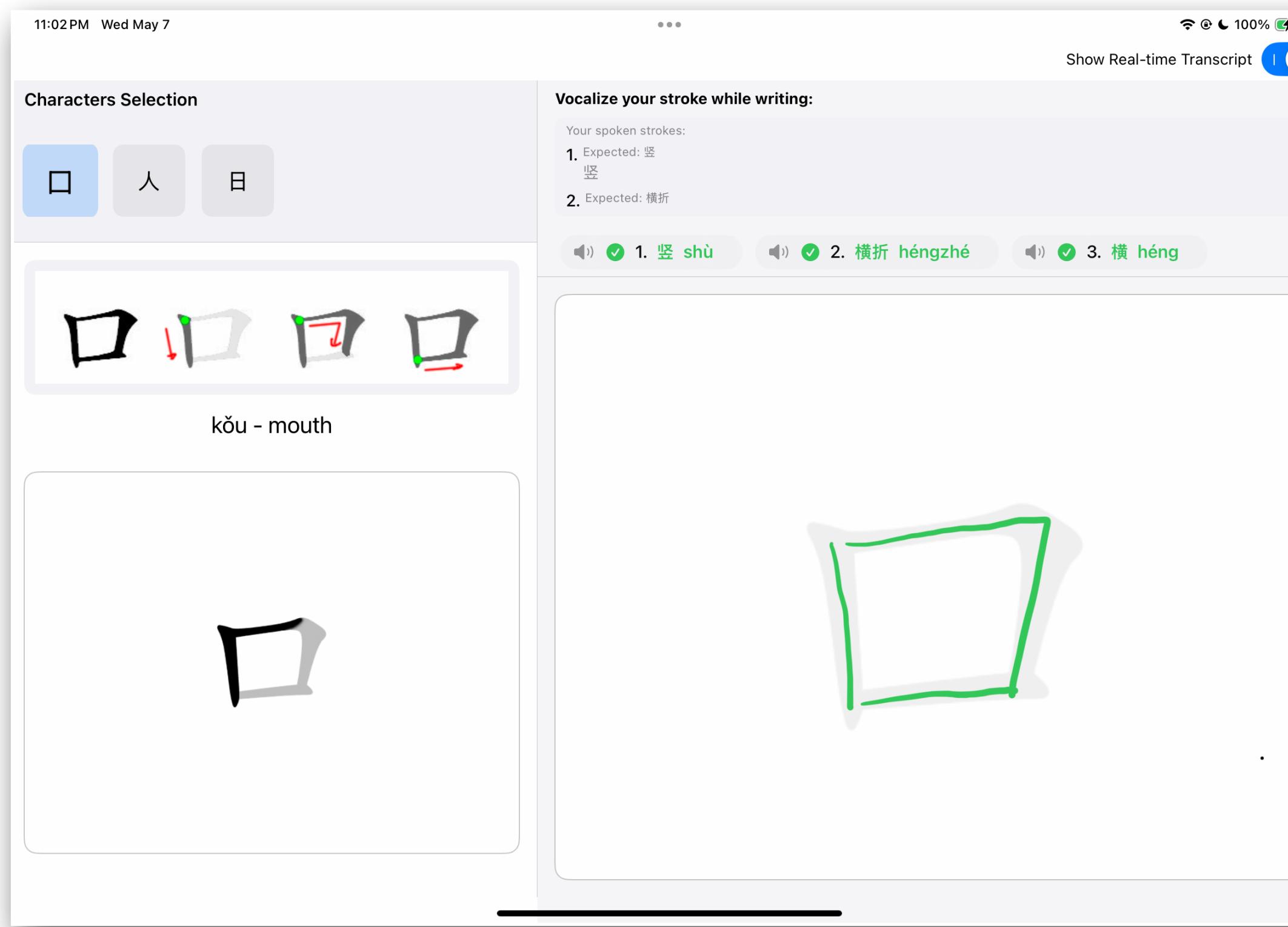
Apple SDKs & a lot of heuristics

- **PencileKit** for pen traces
- **SFSpeechRecognizer** for speech recognition
- **AVFoundation** for example pronunciations
- **WebKit** to render gifs



How well it works

Bad strokes and vocalizations can be caught



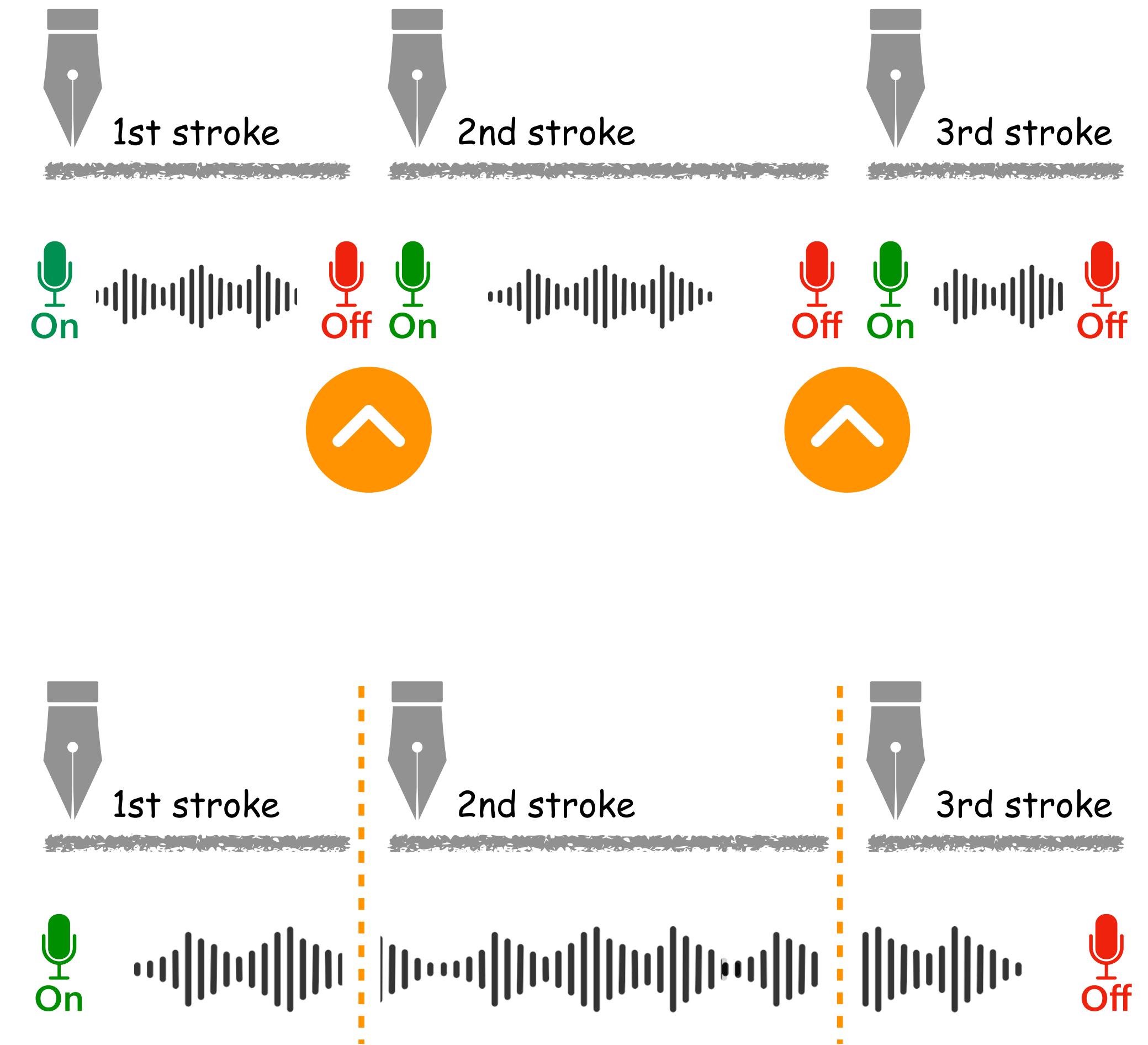


Learnings

Interesting Failure

Timing of speech segmentation

- Originally, speech recognition was started and stopped with **each stroke**
- Mic toggling is **a point of failures** → terrible speech recognition on each audio clip
- Now, speech audio is collected **continuously**, and then segmented **retroactively** for uttered stroke names
- Result: improved reliability



Software Development

Apple Development

- Apple Developer Program restrictions make collaboration across multiple Apple IDs difficult
- Freya has been the only code contributor 



Software Development

Code Logic

- Speech segmentation refined for accurate stroke alignment
- Homophone handling with targeted corrections
- Limited character set, manually curated for quality
- Stroke and speech sensitivity tuned through iterative testing
- **Real world data can be messy!**

The screenshot shows the Xcode interface with the project navigation bar at the top. The project name is "WriteOutLoud". The sidebar on the left displays the project structure:

- WriteOutLoud (root folder)
 - WriteOutLoud (group)
 - App
 - AppDelegate
 - SceneDelegate
 - WriteOutLoudApp
 - Controllers
 - ConcurrencyAnalyzer
 - FeedbackController
 - SpeechRecognitionController
 - StrokeInputController
 - Models
 - Character
 - CharacterDataManager
 - Stroke
 - StrokeType
 - Resources
 - CharacterData
 - Images
 - Sounds
 - Utils
 - Extensions
 - PathUtils
 - SpeechSynthesizer
 - StrokeAnalysis
 - TimestampSynchronizer
 - Views
 - ButtonStyles
 - CanvasView
 - CharacterSelectionView
 - GifImageView
 - GuideView
 - MainView
 - ReferenceView
 - StrokeView
 - WritingPaneView
- Assets
- WriteOutLoud (group)
 - WriteOutLoudTests
 - WriteOutLoudUITests
 - Frameworks
 - Products
 - README

User Testing

Niche audience?

- Chinese speakers found stroke name vocalization redundant
- Non-Chinese speakers struggled with pronunciation accuracy at first
- Currently **more intuitive** for learners with some prior **pronunciation foundation**



Write Out Loud

冰

Show Real-time Transcript

Characters Selection

□ 人 日

Vocalize your stroke while writing:

Your spoken strokes:

1. Expected: 竖
竖

2. Expected: 横折

1. 坚 shù 2. 横折 héngzhé 3. 横 héng

kǒu - mouth

□

口

<https://github.com/junruren/Write-Out-Loud>

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