

Force, 2023 UNIST Design 10th Graduation Show

O-K Text

Hangul Input System in Head Mounted Display
: Utilizing Gaze and Hand Gestures

Designer

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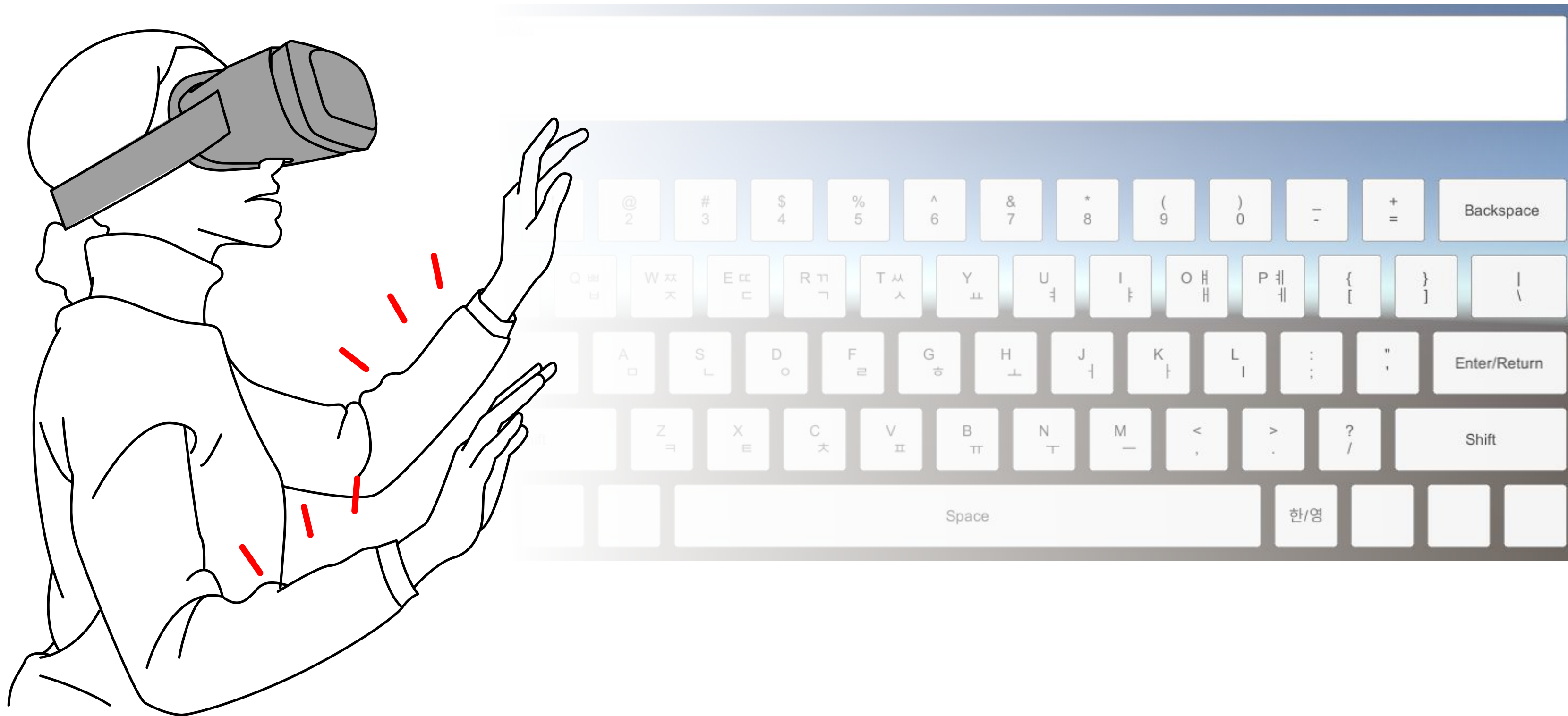
Supervisor

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Problems

Previous VR keyboards's problem



1. To Many Inputs
2. Lack of Haptic Feed back



Significant
Physical Fatigue



Solution with Gaze Interaction

HMD Internal Interactions

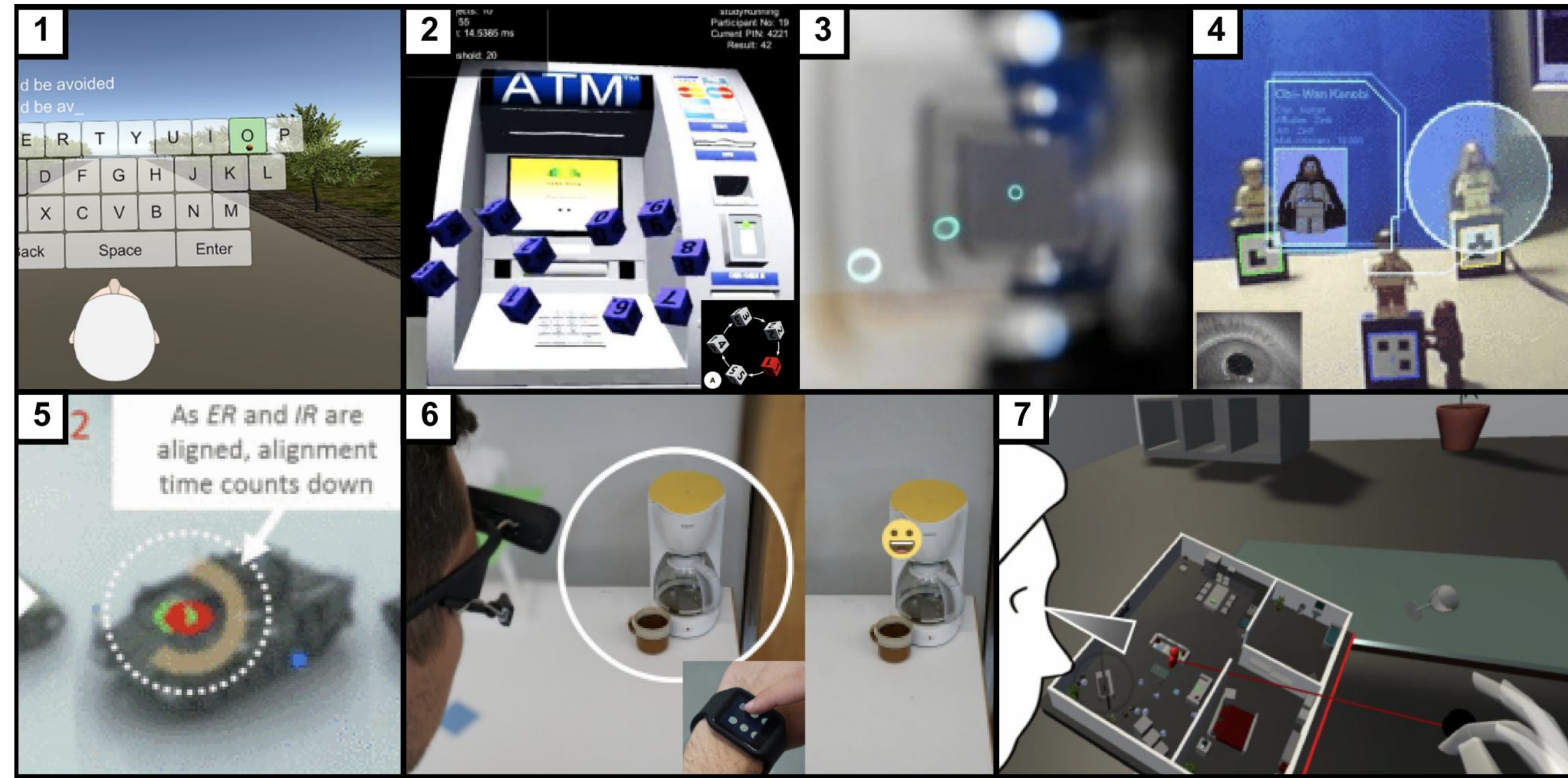
No large gestural controls outside the machine



Reduce physical fatigue,
Natural external user **movement**

Background Research

Explicit Gaze Interaction



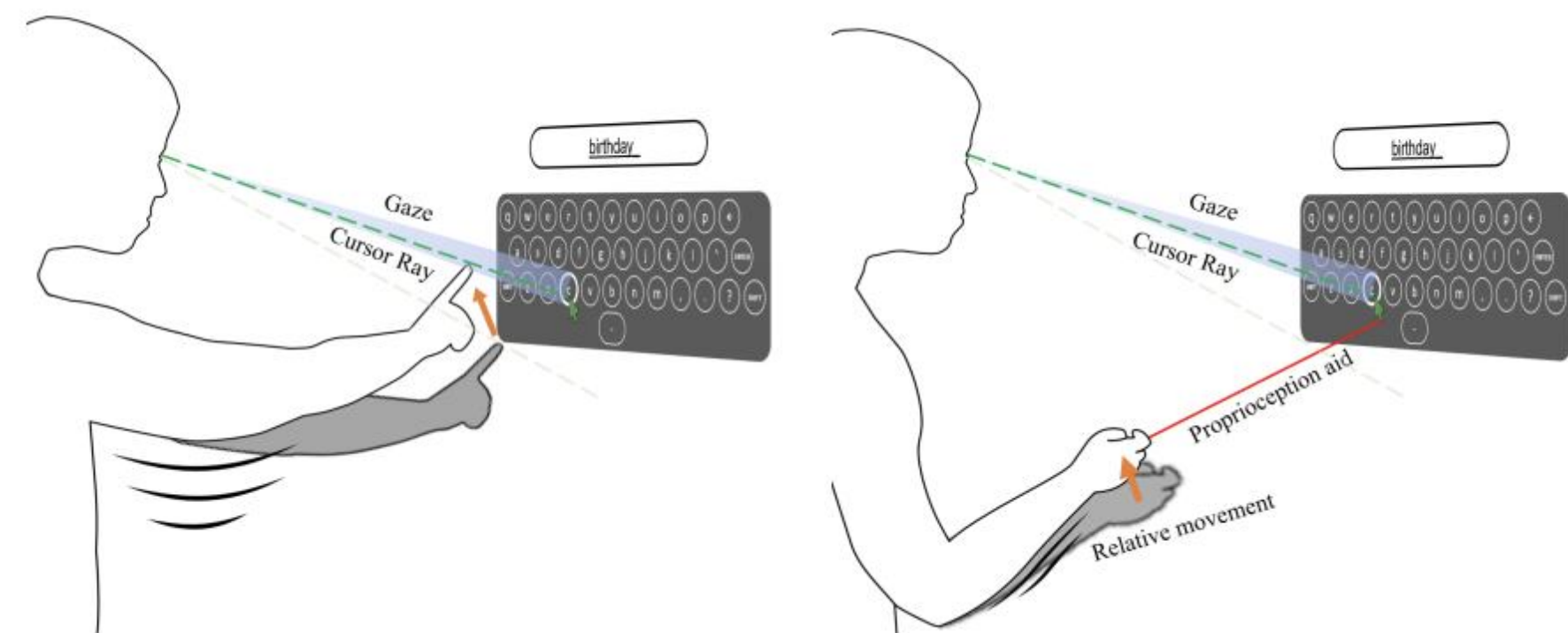
Use Gaze Interaction
as **Dominant Input**

Dwell time
Gaze behavior

Hover, Select

Gaze-based Text Entry Systems

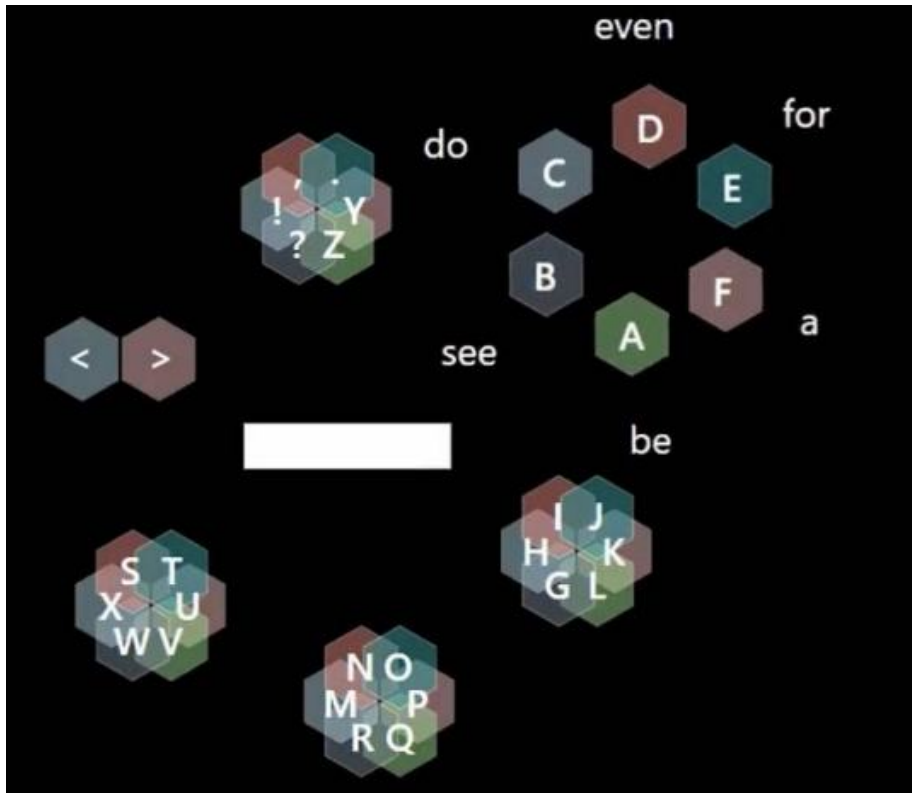
1



Text entry using gaze hand alignment

Exploring gaze for assisting freehand selection-based text entry in Ar. Lystbæk. et al. (2022)

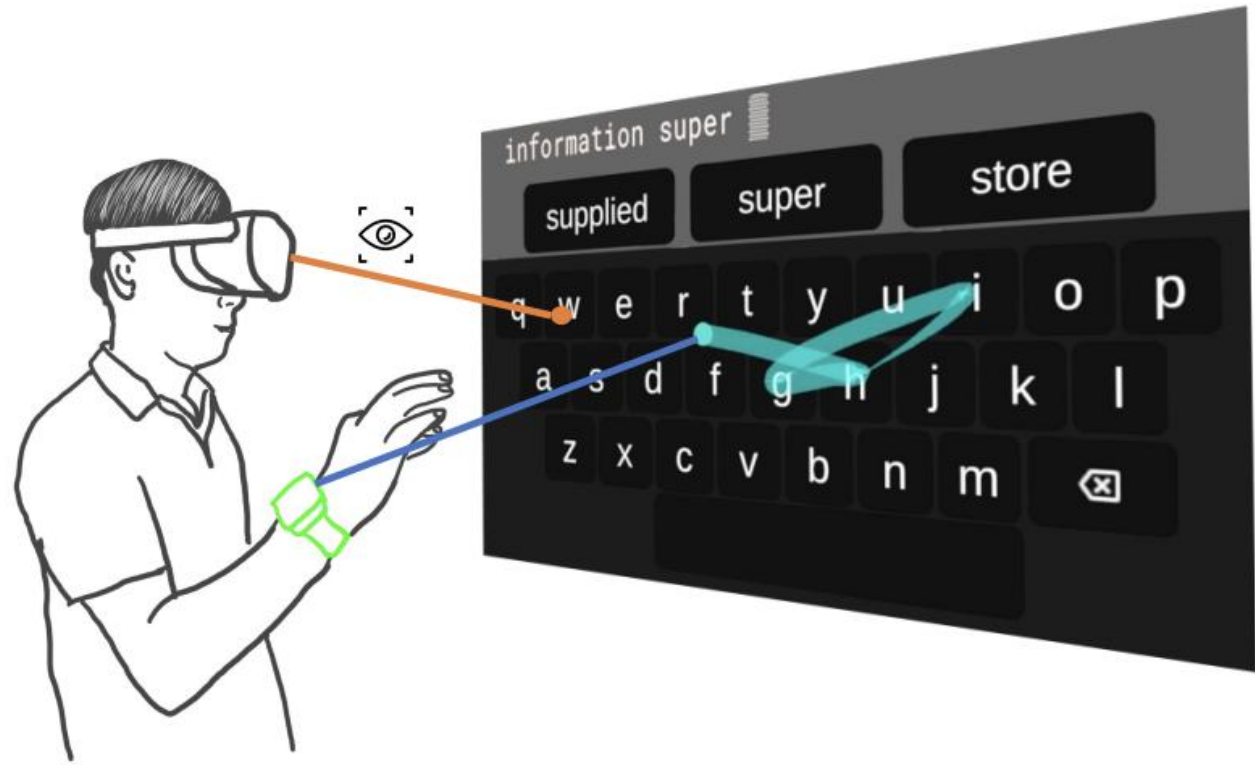
2



Eye gaze only input, using motion correlation

Calibration-free text entry using smooth pursuit eye movements. Abdrabou, Y. et al. (2019).

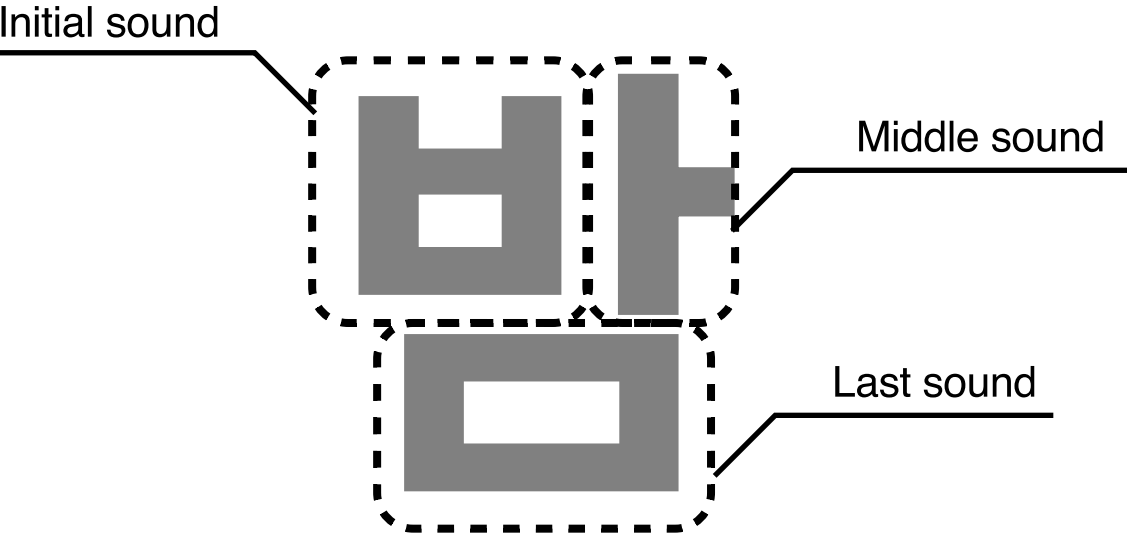
3



Gesture tracking : eye + hand
Using eye tracking to assist the wrist gesture tracking

Gaze speedup: Eye gaze assisted gesture typing in virtual reality. Zhao, M. et al. (2023).

Hangul Structure



Consonants

Regular consonants

ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ	ㅇ	ㅈ	ㅊ
ㄱ		ㄸ			ㅃ	ㅆ		ㅉ	
ㅋ		ㅌ			ㅍ			ㅊ	

Double last sound

ㄹ	→	ㄹㄱ	ㄹㅌ	ㄱ	→	ㄱㅅ
		ㄹㅁ	ㄹㅍ	ㄴ	→	ㄴㅇ
		ㄹㅂ	ㄹㅈ			ㄴㅊ
		ㄹㅅ		ㅂ	→	ㅂㅅ

Vowels

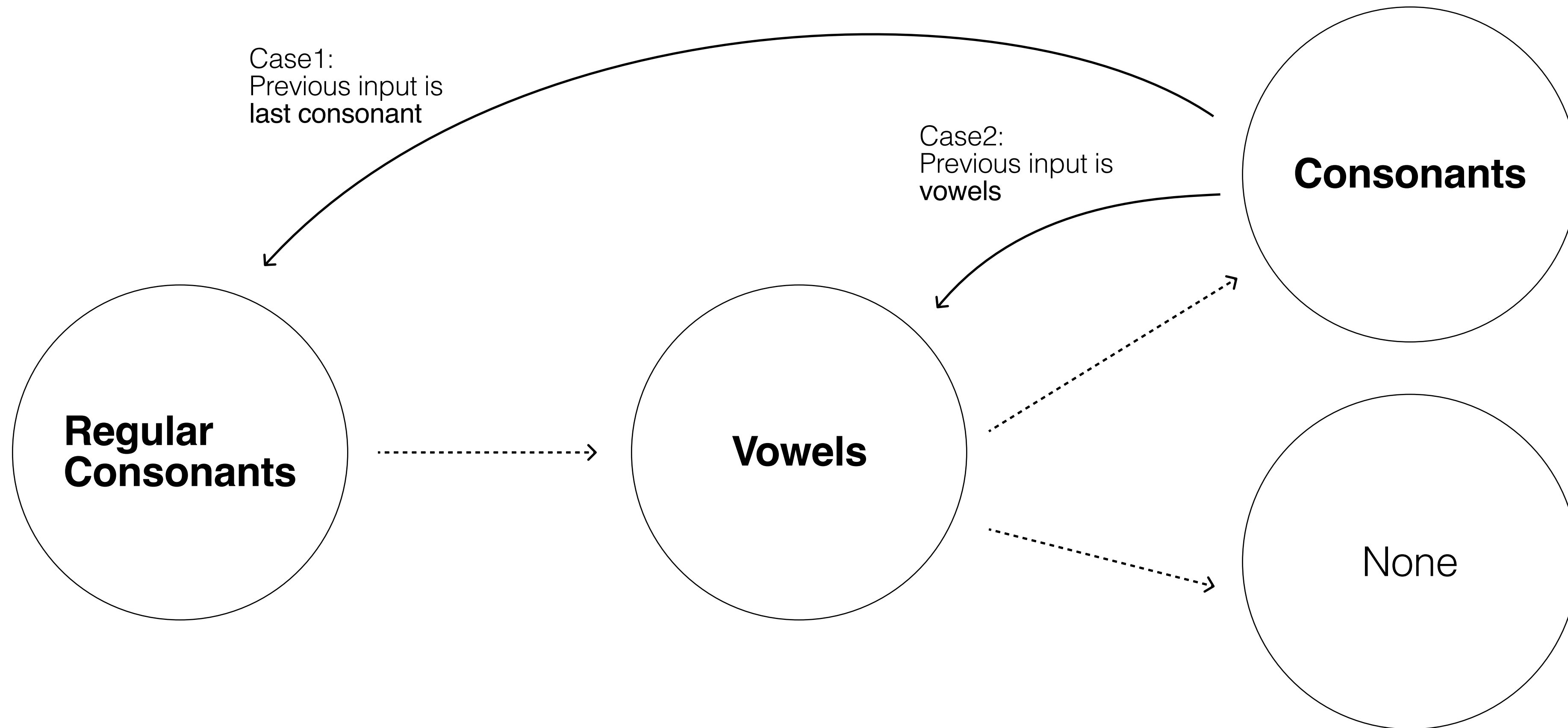
Regular vowels

ㅏ	ㅑ	ㅓ	ㅕ	ㅗ	ㅛ
	+ dot(.)				
ㅙ	ㅛ	ㅜ	ㅠ		

Compound vowels

ㅗ	→	ㅜ	ㅑ	ㅓ	ㅕ	ㅗ	→	ㅛ
		ㅙ	ㅛ	ㅜ	ㅠ	ㅑ	→	ㅑ
		ㅙ	ㅛ					
		ㅙ						

Korean text entry system

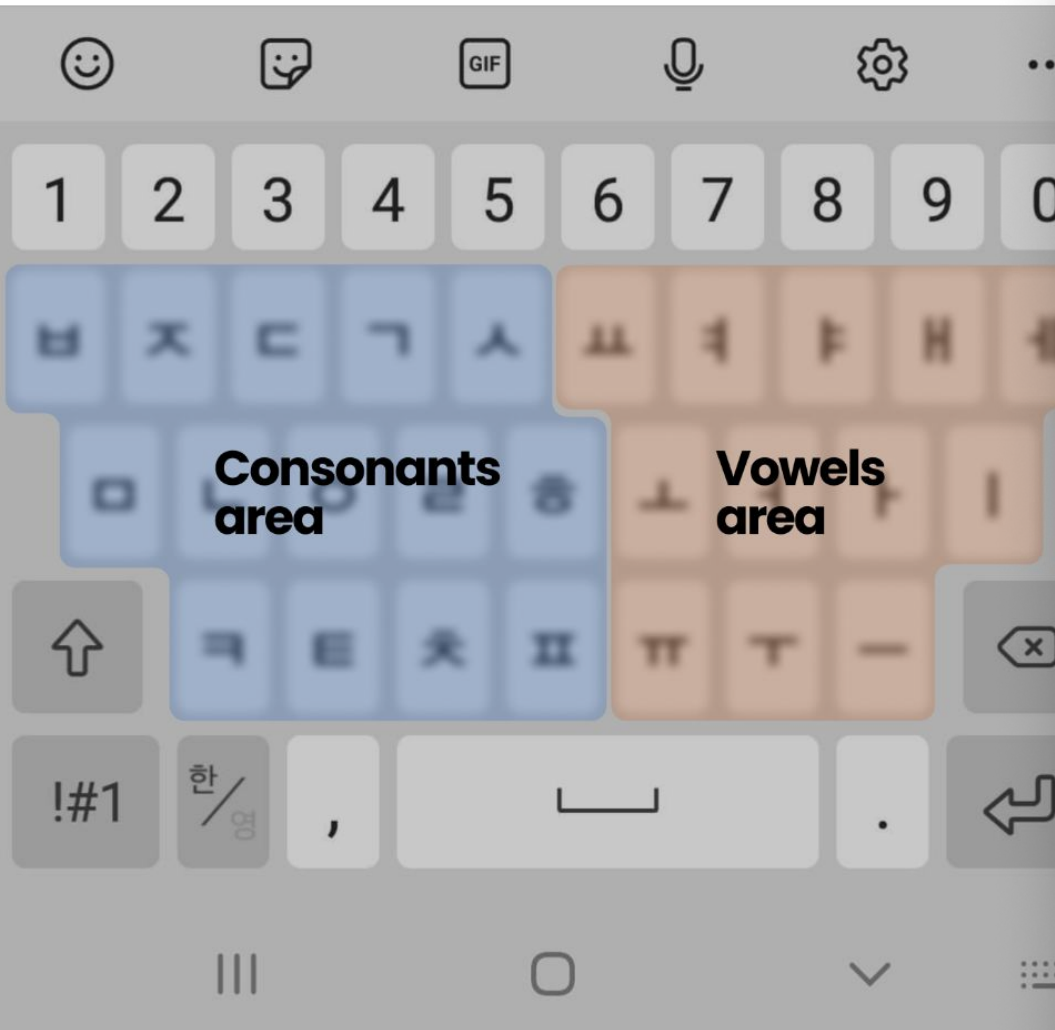


Divided consonants and vowels area

Reduce typing time by alternating between two hands based on input sequence



Korean can be input with **different interactions** between **consonants** and **vowels**

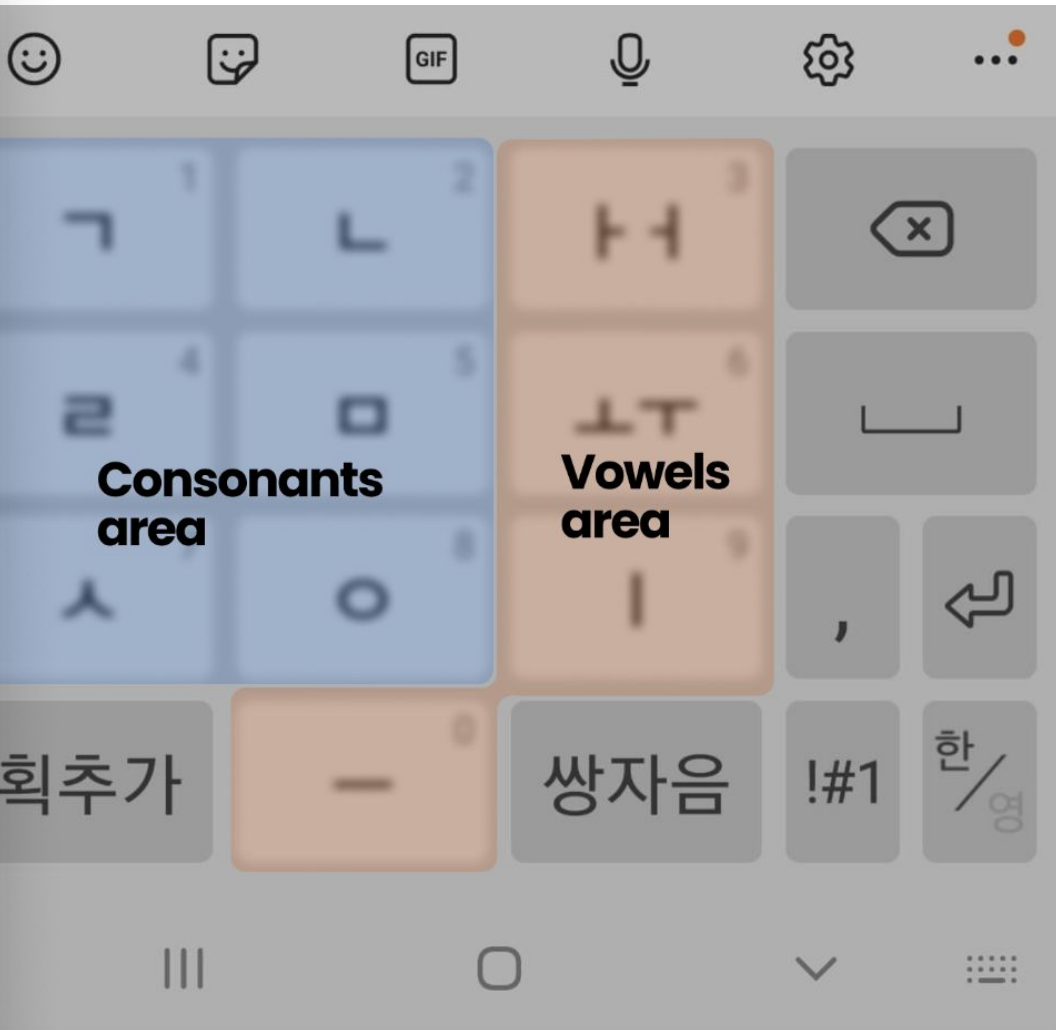
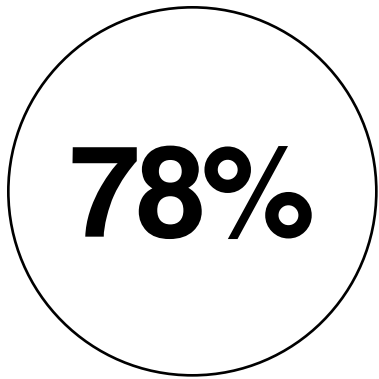


QWERTY

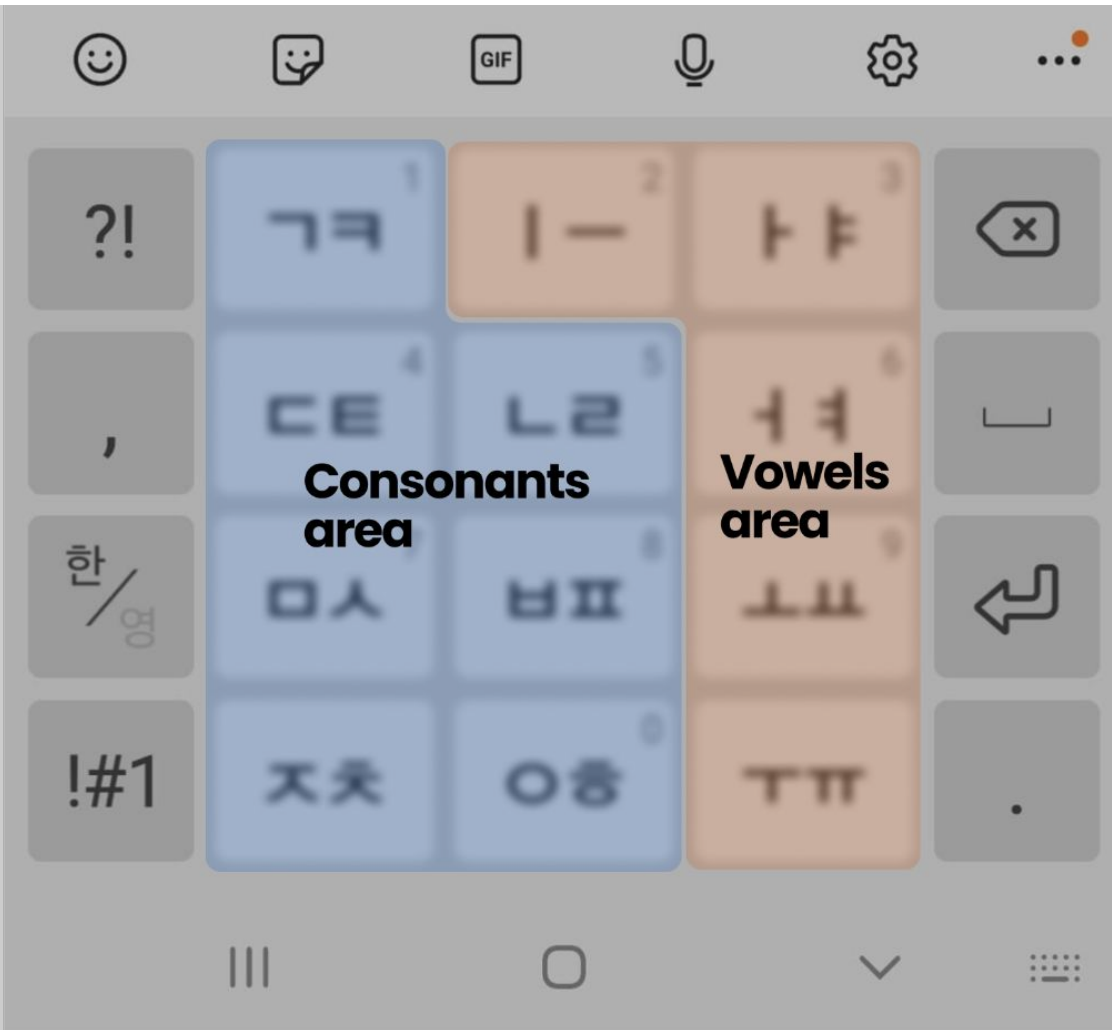


Cheonjiin

The first consonant typed on **Cheonjiin** is most likely to be an initial sound at



NaraGuel



Vega

Project Goals

Project Goals

1

Design a consonant Gaze tracking layout for input.

2

Design low effort finger taps vowel input interactions.

3

Design both interactions to be a natural experience.

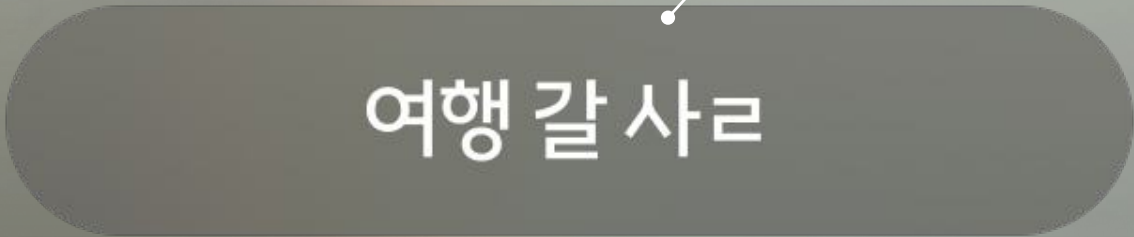
O-K Text

Eye-tracking system

First Depth Scene

Consonants groups

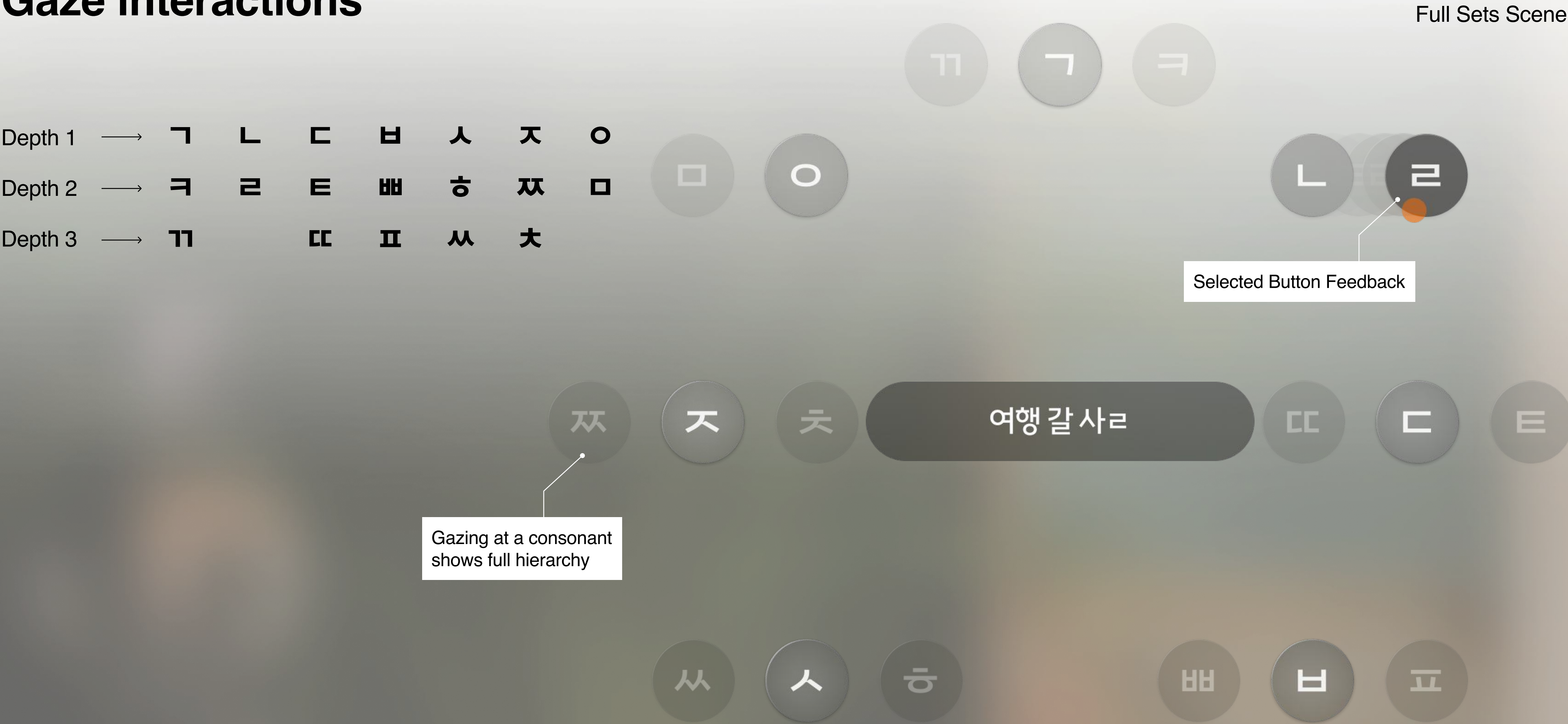
Depth 1	→	ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ
Depth 2	→	ㅋ	ㄴ	ㅌ	ㄹ	ㅍ	ㅅ	ㅇ
Depth 3	→	ㄱ		ㄷ	ㅌ	ㅍ	ㅅ	ㅊ



Gaze Interactable buttons

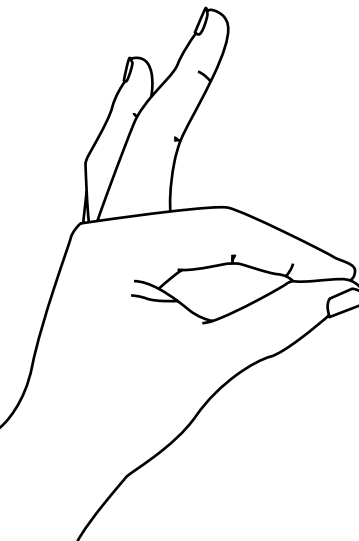


Gaze interactions

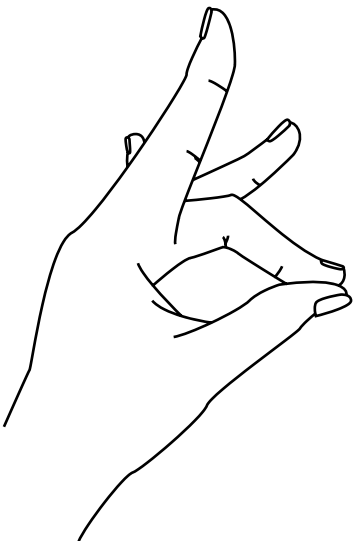


Hand Interactions

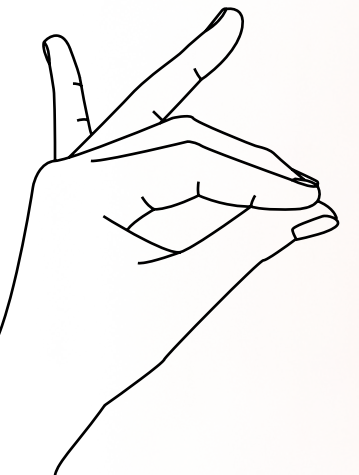
Left Hand



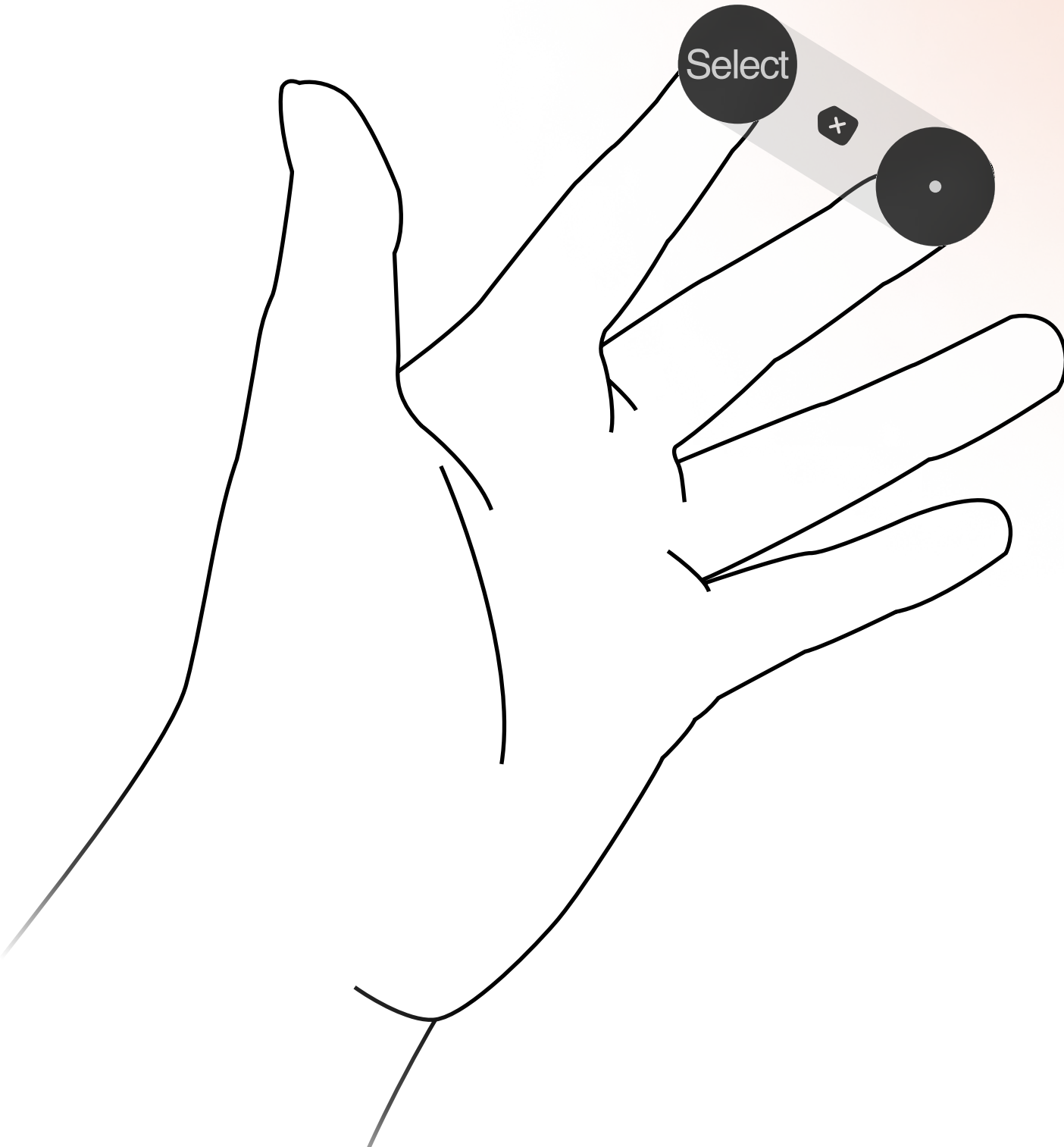
Select Consonants



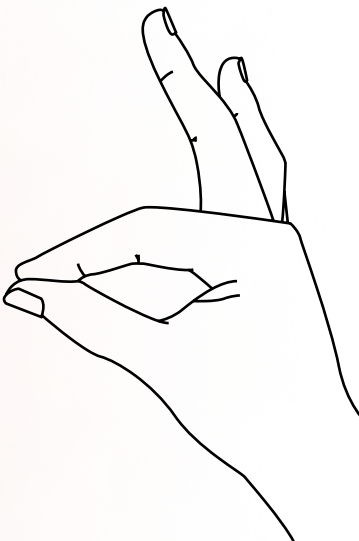
Add Vowels Stroke



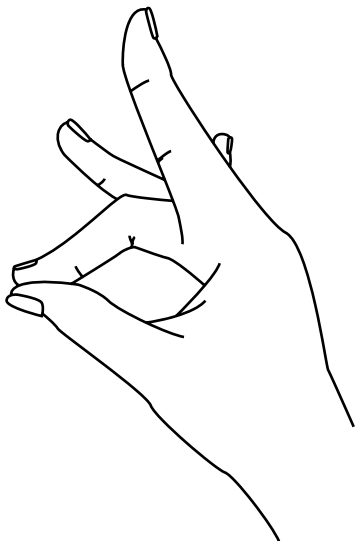
BackSpace



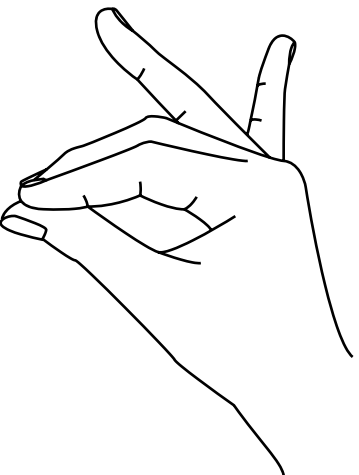
Right Hand



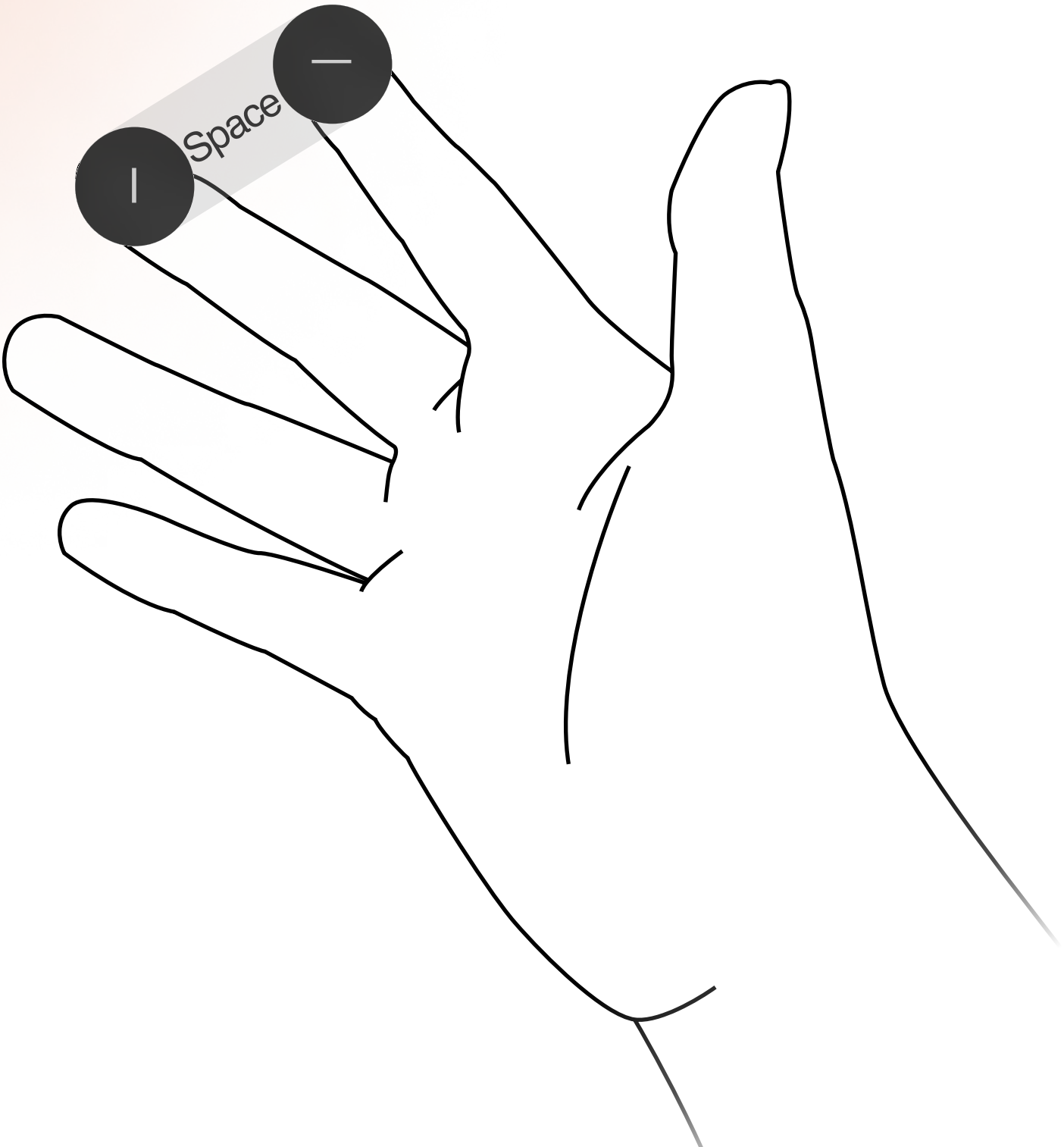
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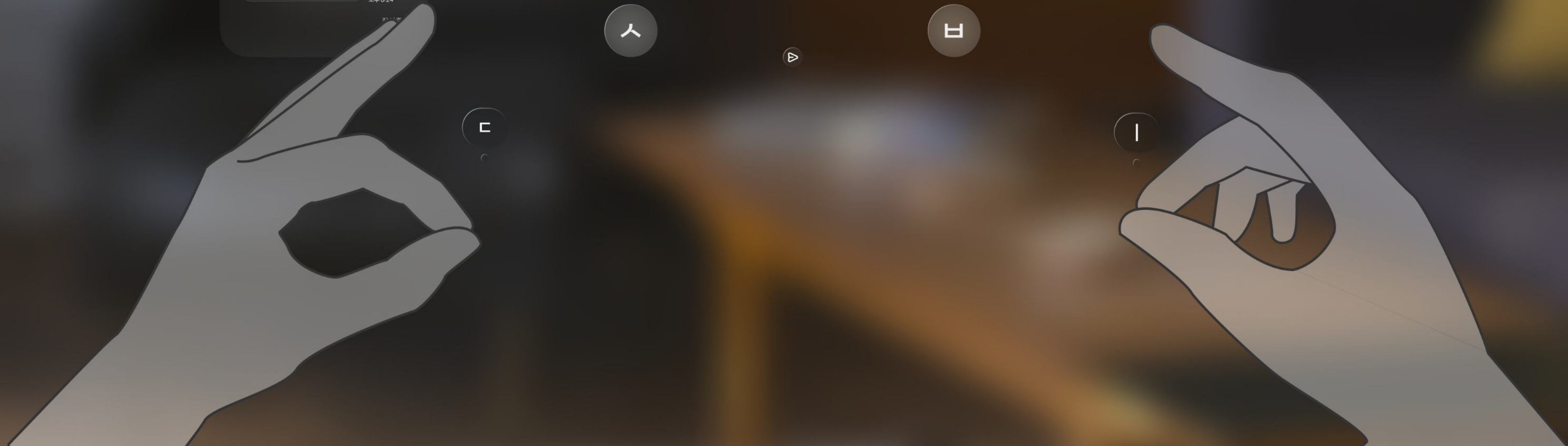
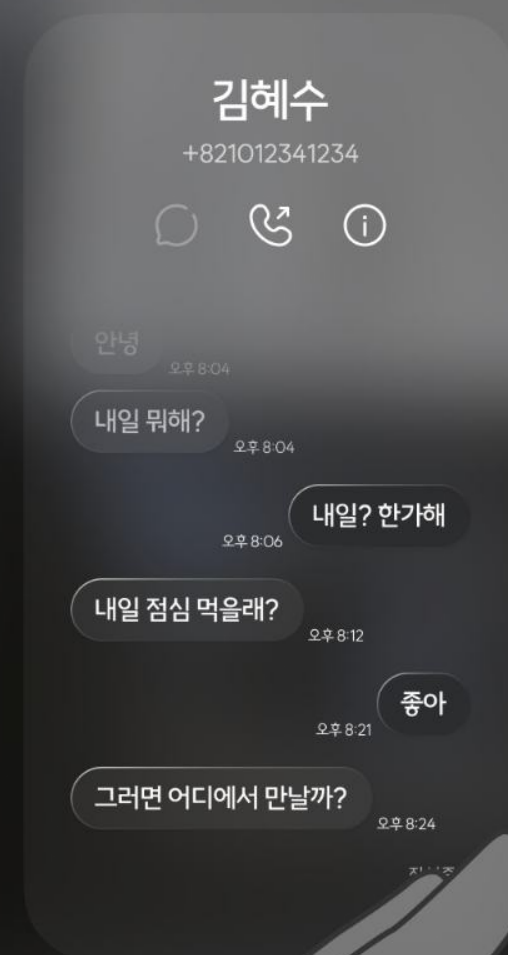
|



Space



Overall Design

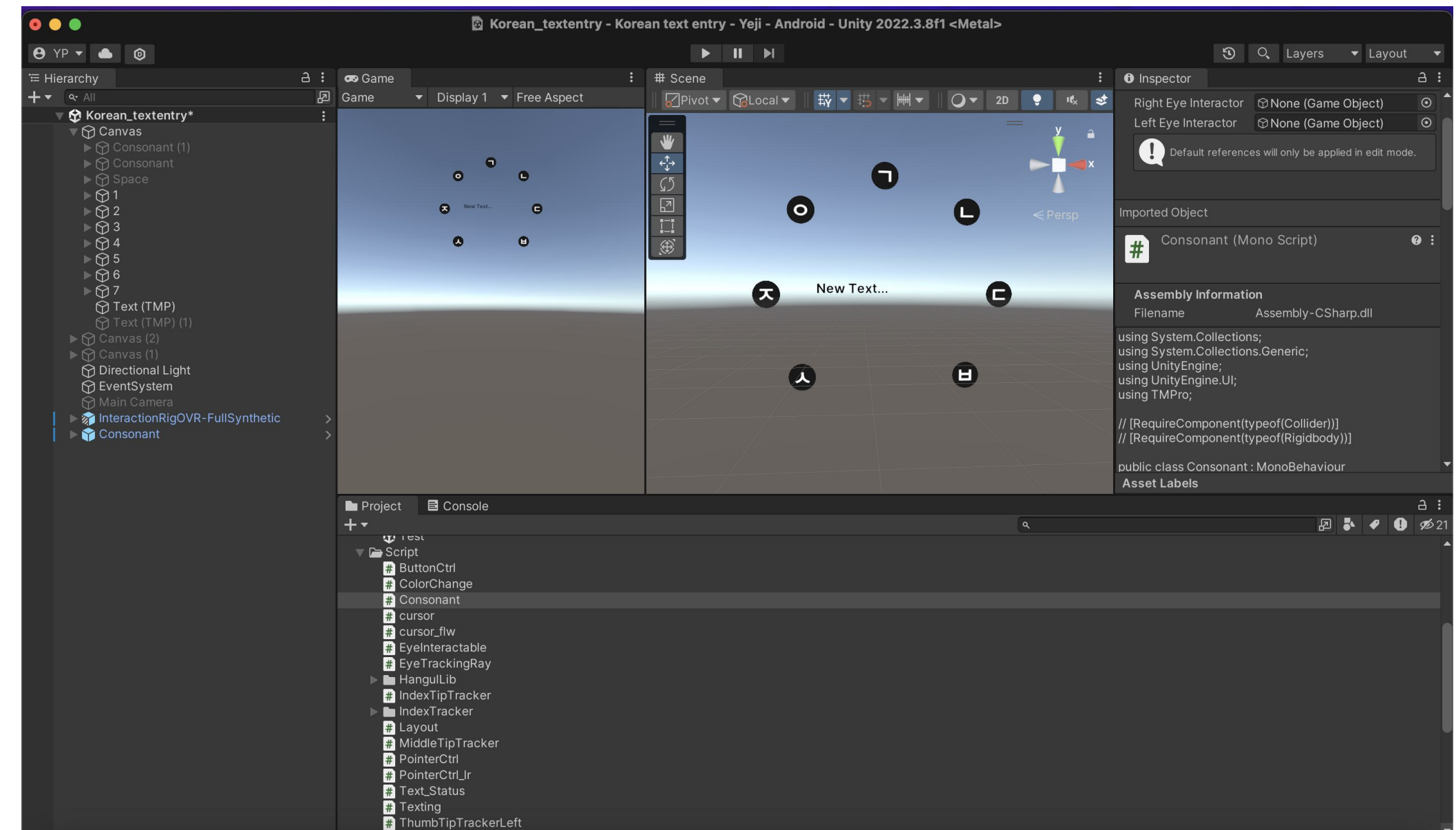


Prototype

Equipment & Tools

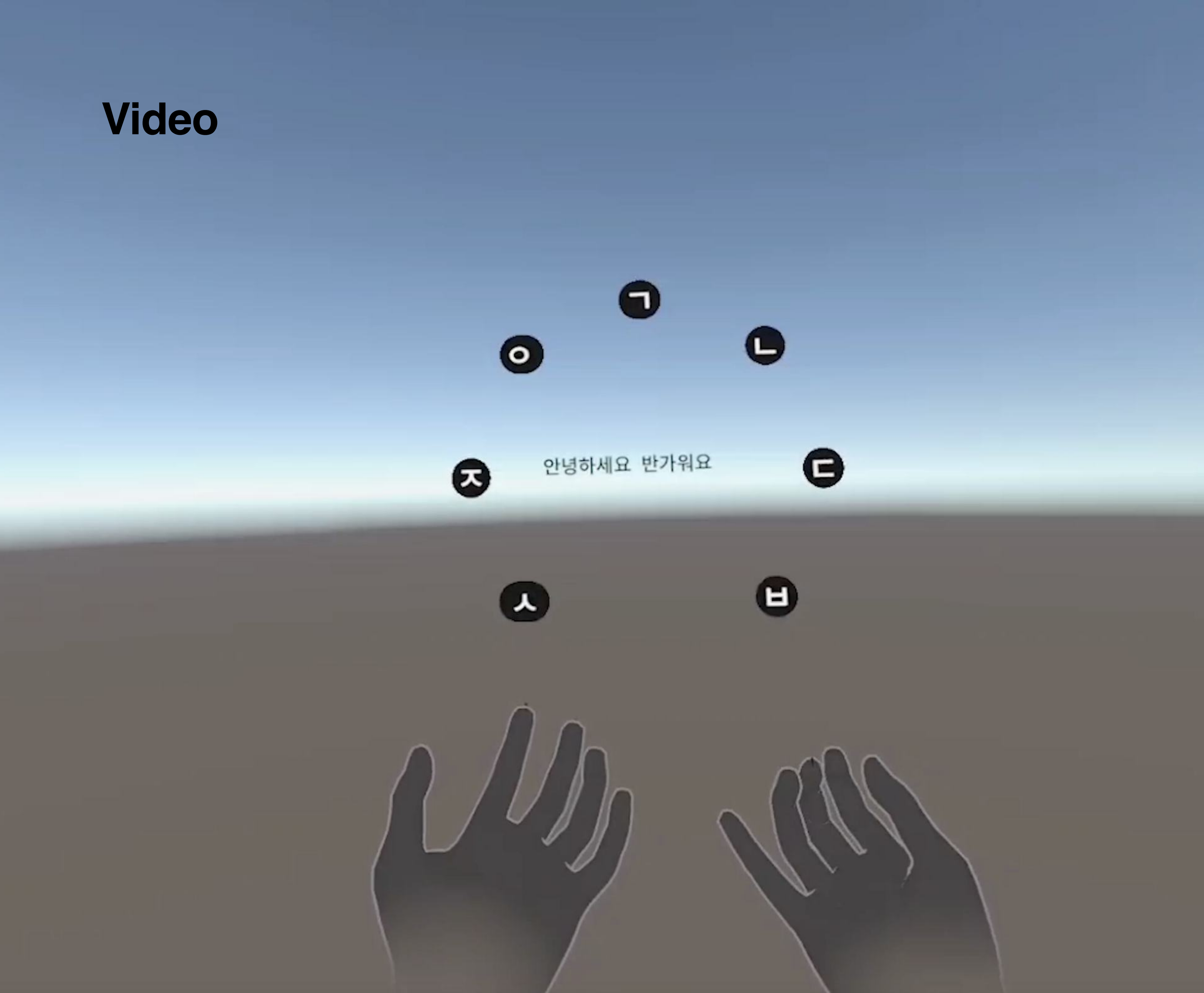


Meta Quest Pro



UNITY Engine 2022.3.8f

Video



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Usability Evaluation



Usability Evaluation Method

Word Representation Test

5 Words, 7times



Measure **Word Per Minute (WPM)**
and **Word Error Rate (WER)**

Word Information

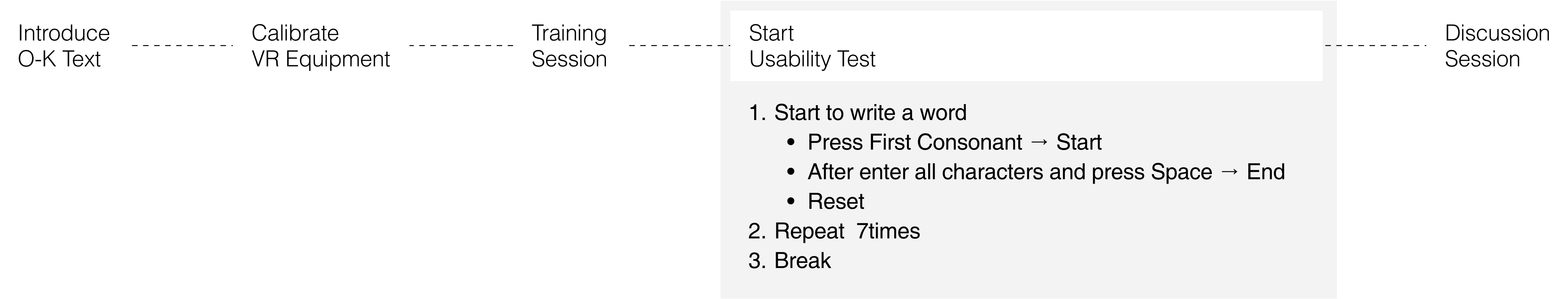
Word	Total Key Stroke	Character	Letter	KeyStroke Per Character	KeyStroke Per Letter
더위	7	2	4	3.5	1.75
단감	8	2	6	4	1.33
샘	5	1	3	5	1.67
연필	8	2	6	4	1.33
감사	7	2	5	3.5	1.4
Average	7	1.8	4.8	4	1.50

학교

Character → 학, 교
Letters → ㅎ, ㅣ, ㄱ, ㅓ, ㅍ

Usability Evaluation Method

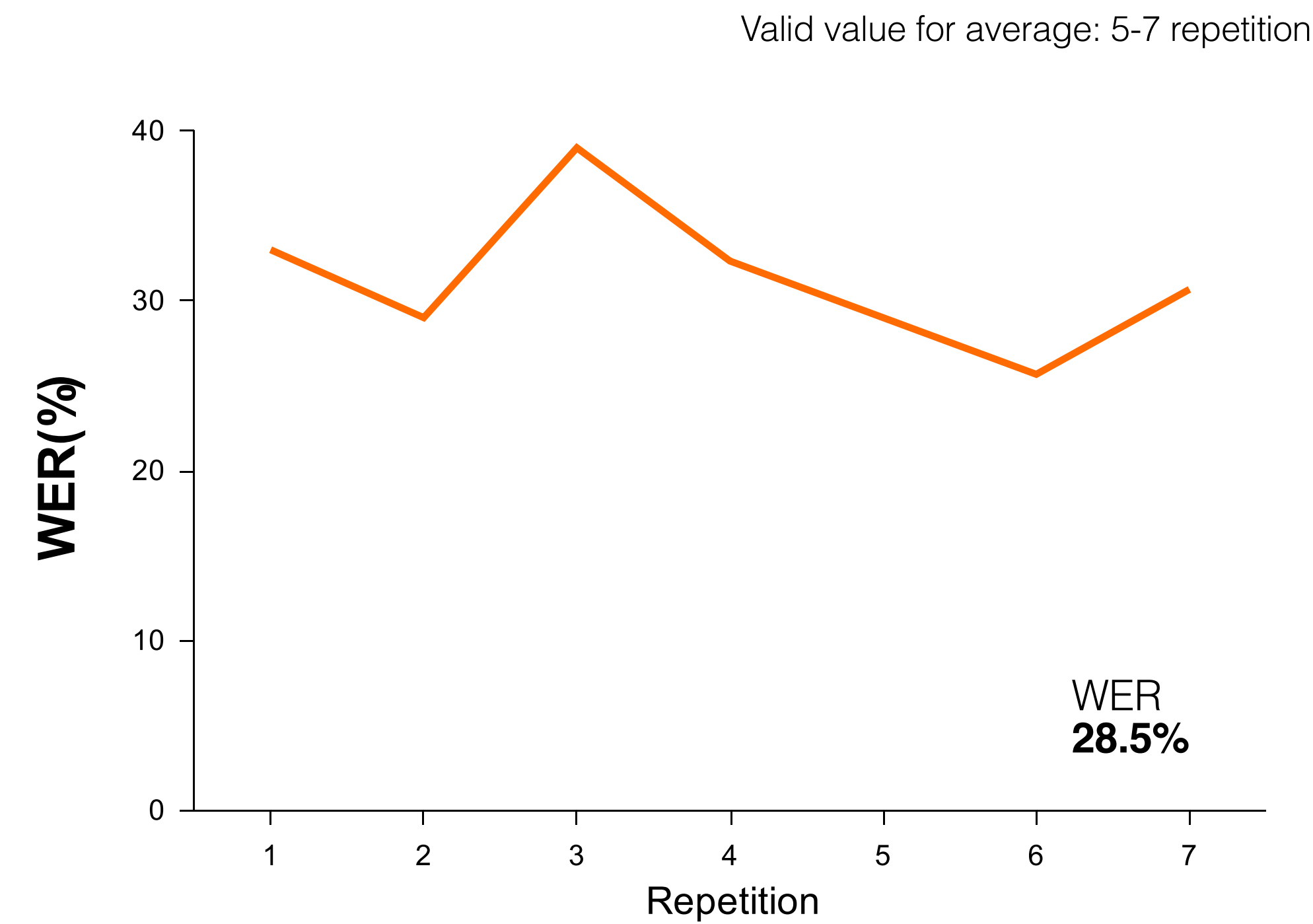
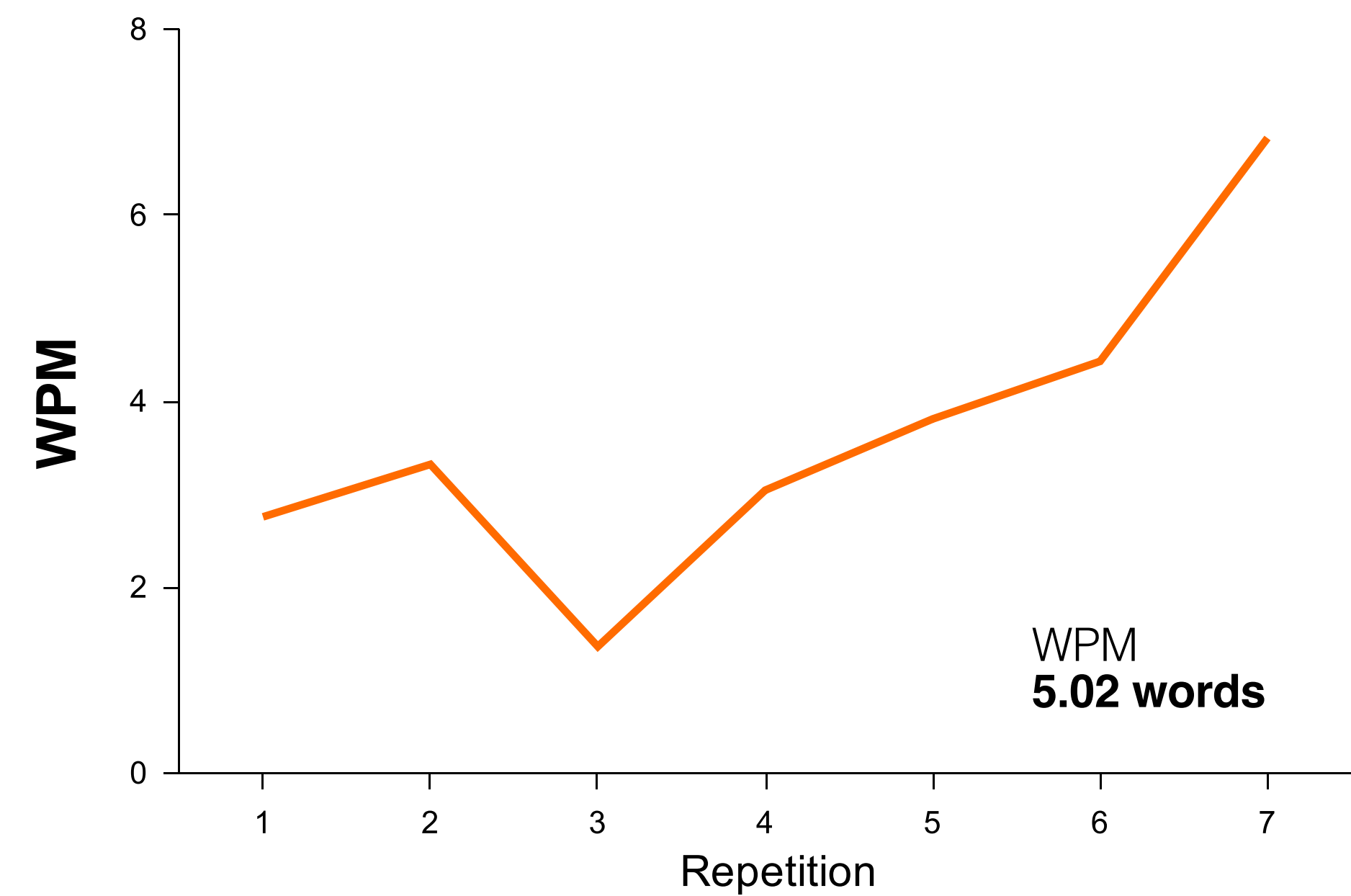
Procedure



Participants



Result



Discussion

1

Difficulty recognizing
consonants and hand input
who has never used Cheonjiin.

2

Since the select button is in the
hand, it feels like vowels and
consonants are **not separated**.

3

Inaccuracy in hand input
break the flow of writing

Future Work

Future Work

1

Redesigning the input
visibility method.

2

Need to restructure input
methods for vowel and
consonant input

3

Functional workarounds for
hand input accuracy

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