

# A Study on Design for Diagnostic Tool for Language Processing Ability with Aging - Focused on 'Verb Naming'

Seoul, South Korea

The deterioration of linguistic abilities is a natural phenomenon along with aging. Therefore, various assessment tools have been developed to measure linguistic abilities of seniors and diagnose degenerative diseases such as dementia. Although most of the tools are composed of images, there are not many studies focusing on the visual design, which could significantly affect performance of the subject. In this regard, this research aims to suggest a design guideline for linguistic ability assessment tools concerning the key characteristics of the elderly, focusing on visual contents and interface.

Existing related researches were mostly conducted in English-speaking countries. In order to assess the language processing abilities of Korean-speaking elders more accurately, it is necessary to develop language processing assessment tools that reflect the unique linguistic features and structure of the Korean language. Regarding the existing tools, there is a lack of research on aging, focusing on 'verb naming'.

In the literature review section, the paper investigated the physical, cognitive and emotional characteristics of the elderly and extracted the key elements to consider when designing for the elderly. Also, design principles were found based on case studies and problem analysis of the existing assessment tools for language processing abilities. Lastly, we created a prototype model using 'verb naming'. Using the model, we have conducted an experiment and comparative analysis between different age groups to verify the validity of contents.

In conclusion, we provided a design guideline for visual contents and interface of linguistic assessment tools, focusing on elderly users.

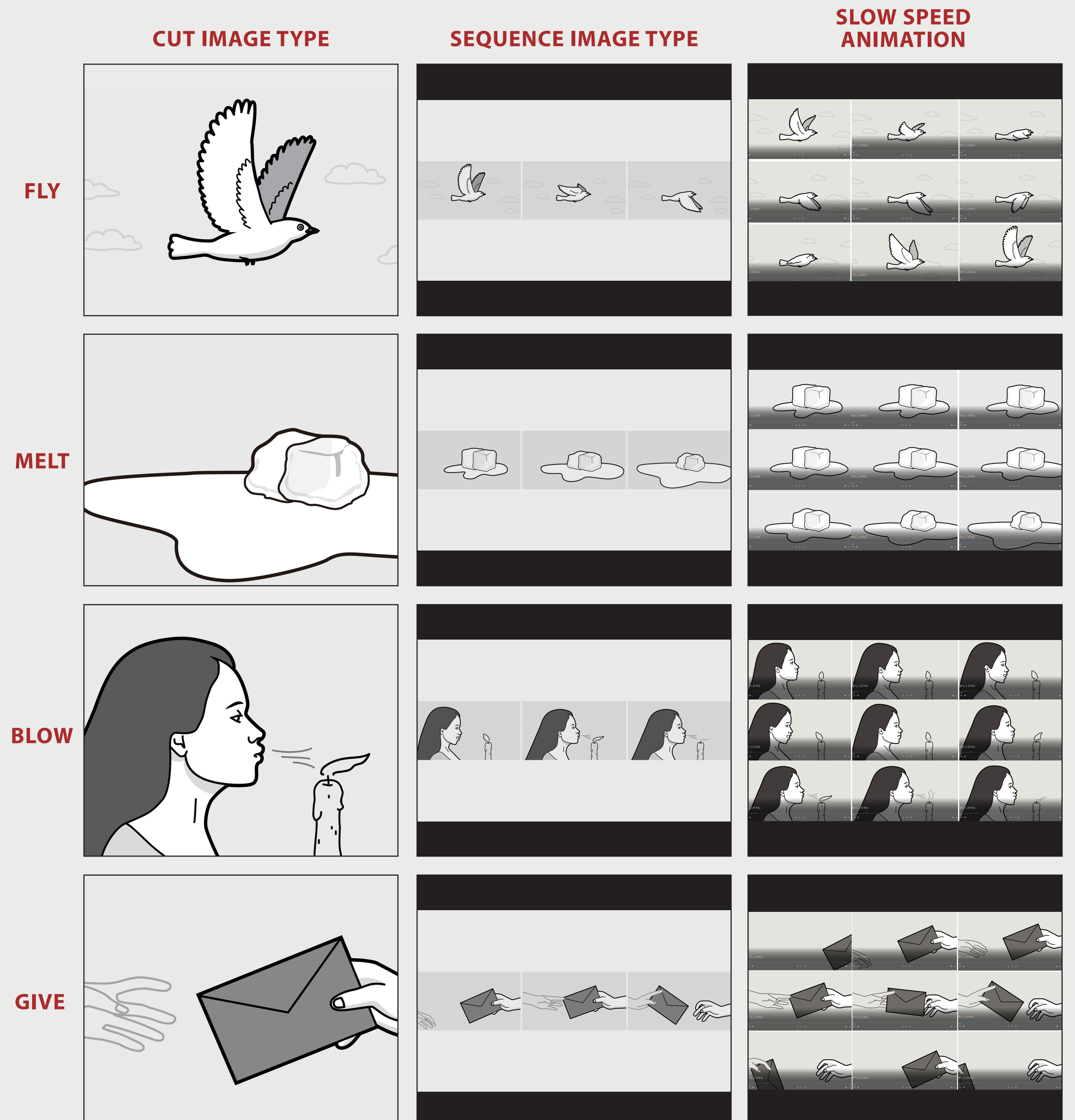
## Guidelines for Interface Design of Language Ability Diagnostic Tools

Based on literature review and test results of the prototypes above, we suggest the following guidelines for interface design.

ELEMENTS	CONTENTS
STYLE	Within the same task, styles should be expressed in unity. To control the complexity of the target vocabulary (noun, verb, etc.), we recommend realistic illustration styles rather than live shots. Encourage line drawing styles. Avoid overly distinctive styles and use a universal style to clarify information delivery.
COMPLEXITY	The visual complexity must be lowered by excluding the ornamental Elements other than objects expressing the target vocabulary. Only when the object expressing the target vocabulary is too simple, it is Allowed to describe the surrounding elements for the purpose of matching the visual complexity with other contents.
FORM	Use the universal and realistic form, but reduce any ornamental depiction.
COLOR	Use a color scheme with a high contrast of lightness, saturation, and color.
LINE	Avoid using thin line for high visibility and use thick line.
LAYOUT	The size of the object or person expressing the target vocabulary should be more than 40% of the screen. Use a simple layout and a generous margin. Avoid showing elements in layers.
BRIGHTNESS	When using electronic media, avoid using a large area of white (# 000000) and apply light gray.
MOTION SPEED	In the case of animation, approximately 120% duration is applied than the normal speed.

## Prototype for 'Verb Naming' Tool

The prototype of each representative verb is composed of four components: one cut image, sequence of images, normal speed animation, and slow speed animation (normal-speed of 120). It is made in achromatic color with a high brightness contrast for the old age group with low color perception. We used the universal and realistic shape, and reduced decorative features. Also, we used simple layouts and generous margins. Reflected light is applied to the whole background in consideration of the elderly who have difficulty adapting to light reflection.



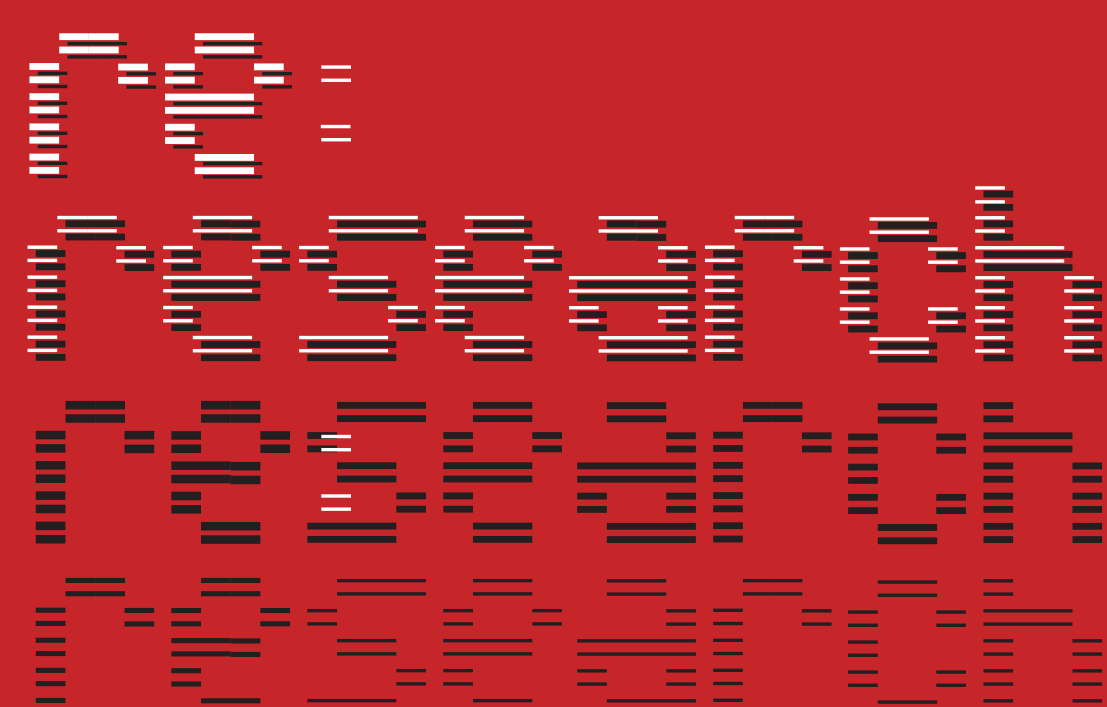
For user test, this study was conducted for 16 young people aged 20 ~ 39 and 16 elderly people aged 65 or older only as a control group for comparison of results.

Time spent between groups (unit: second)

	ONE CUT IMAGE	SEQUENCE OF IMAGE	NORMAL SPEED ANIMATION	SLOW SPEED ANIMATION
OLD	5.71875	6.34375	4.53125	3.84375
YOUNG	1.40625	1.375	1.28125	1.65625

The results show there was a significant difference in the response time between the two groups for all four stimulation types. Moreover, for the elderly, the speed of cognitive recognition was fastest when presented the stimulation was presented in the slow speed animation form. This suggests that the speed of animation can affect the speed of cognitive response among the elderly.

This study has clinical significance in that it presents basic guidelines for future research on contents and interface design for language ability diagnostic tools. However, there are some limitations and avenues for future research. First, we have only tested 4 verb types among 24. Second, the number of participants (32 in total) for the testing seem to be relatively small. Third, we divided the age group into two groups, but it could be divided into shorter age-span groups to analyze differences in performance and response time along with aging, in the future.



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