# STEPS Students Report

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**Neuropsychological aspects of visual perception of city design and landscape: cross-comparative study**

## Introduction

The problem of hemispheric asymmetry has been very common from the beginning of the brain studies. John Hughlings Jackson suggested in 1861 that the right hemisphere is responsible primarily for visual perception of the external world, in contrast to the left hemisphere, which predominantly controls speech and related processes; the right hemisphere, in his opinion, can only perceive such verbal formulas that are not parted, but are connected with a holistic, automatically pronounced designation of the whole situation ("Hello", "Please"). Further research by different authors confirms the dichotomy of the two hemispheres and opens up new aspects of it. Thus, the left hemisphere has a successive, analytical strategy for processing information; responsible for the perception of the already familiar stimuli. The right hemisphere, by contrast, has a simultaneous, synthetic strategy and is responsible for the perception of novelty.

One of the most interesting questions about hemispheric asymmetry is cultural features and possibility of cultural influence on structural development of the brain.

There is a hypothesis (originally suggested by Ornstein in 1972 [1]), that the brain of Asian people is not the same as brain of Europeans and Americans: Eastern people have more developed right hemisphere, while Western people have stronger left hemisphere. Another interesting point of view was presented by Tadanobu Tsunoda [2]. He suggested that Japanese brain could be different because of hieroglyphic writing system, that may involve right hemisphere because of its figurativeness.

Consequently, we can hypothesize that Japanese people are faster in perception of images, than in perception of symbols (letters, words, etc.). This hypothesis could be useful for such important question as designation in urban landscapes, especially for warning and prohibition signs. It may be assumed that image signs will be more effective and attractive in Japan, than written signs.

**Purpose**

To investigate visual perception features of the Japanese for various landscape signs.

**Hypotheses**

1) Japanese perceive image-signs more effective then written signs
2) Japanese have more developed right hemisphere in comparison with Russians:

- Interference will be lower in reading of Kanji then hiragana (in Japanese sample) in Stroop Test
- Interference will be lower in reading of Kanji (in Japanese sample) then reading letters (in Russian sample) in Stroop Test
- Perception of signs will be better in left visual field in Japanese sample (in Videotape Task)

**Objectives**

1) to compare perception of image-signs and written signs of both groups (Japanese and Russians) with specially developed task, which aimed to compare attention and time of perception image-signs and written signs
2) to analyze theoretic and empirical data about features of right hemisphere's functioning of both groups (Japanese and Russians)
3) to compare right hemisphere's functions of both groups (Japanese and Russians) according to the results of investigation.

**Participants**

Two groups of people: Russians and Japanese, in age about 18-25, right-handed, without any brain lesions (students of Moscow State University and students of University of Tokyo respectively).

**Methods**

3) Specially developed task, which includes short videotapes (3 videotapes, 15 second each, plus trial series), represented to research participants. At this videotapes participant will see a road in motion (like in a driving simulator) with some road signs on both sides. There are three types of signs: images, hiragana/katakana writing and hieroglyphic writing in Japanese sample and two types of signs – written signs and images – in Russian sample.

During viewing of the videotape participant should look at the center of the screen. After viewing the videotape participant will be asked about signs which he involuntarily saw: about number of signs; about recognizing these signs. Thus we can measure involuntary attention and memorization for understanding of these aspects of signs' perception.

4) Modificated version of Stroop Test (for Japanese sample) to compare interference effect in hiragana/katakana and hieroglific reading; and classic version of Stroop test (for Russian sample).

Pages with stimuli were presented in such order for Japanese sample:

1. Names of colors written with hiragana signs, black ink
2. Names of colors written with kanji signs, black ink
3. Colors
4. Names of colors written with hiragana signs, with opposite color ink
5. Names of colors written with kanji signs, with opposite color ink

For Russian sample it was usual version of Stroop Test in Russian language.

**Results**

For this month it was possible to test only first hypothesis and partly the second one, 'cause last part requires participation of Russian sample, which is planned to do in the next part of this investigation.

Videotape Task

Table 1. Perception of pictures, hiragana/katakana words and kanji words

| | Pictures | Hiragana/Katakana | Kanji |
|---|---|---|---|
| Stimuli | 3.4 | 3.1 | 3.1 |

Stimuli – arithmetical mean of number of signs, which were recognized by each participant, counted separately: number of recognized images, hiragana/katakana words and kanji words. Thus, we can see, that images are processed better than symbols – hiragana/katakana and kanji, but there are no difference in processing between hiragana/katakana words and kanji words in this task.

Table 2. Increasing of right answers from watching of 1st videotape to 3rd.

| | Videotape 1 | Videotape 2 | Videotape 3 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Number of right answers | 3.3 | 3.5 | 4.2 |

Number of right answers – number of rightly recognized signs after watching each videotape (1,2,3).
Also it could be noticed that number of right answers increases from watching first videotape to third: so we can see an adaptation to task after few presentations.

Table 3. Right and left perception.

| | Right Visual Field | Left Visual Field |
|---|---|---|
| Number of Stimuli | 121 | 102 |
| Mean | 4.5 | 3.7 |

Number of Stimuli – number of signs, which were recognized after presentation in only right or only left visual field, counted with results of whole sample;
Mean – arithmetical mean of number of signs, which were recognized after presentation in only right or only left visual field, counted with results of each participant.

To compare perception in right and left visual fields we can see difference: all kinds of stimuli are processed better in right visual field, which possibly could present dominant role of left hemisphere in processing of this task. But it should be checked on bigger sample of participants.

Stroop Test
In this research we got such kind of results using Stroop Test:

Table 4. Interference level in Japanese sample.

| | Interference Hiragana | Interference Kanji |
|---|---|---|
| Japanese | 50 | 46 |

Interference – T-score counted by results of comparison predicted Color-Word score and actual Color-Word score of Stroop Test.

These results confirm hypothesis that Kanji symbols less exposed to Stroop Effect than Hiragana symbols. It could be because of figurativeness of Kanji in comparison with Hiragana (and letters as well). Processing of Kanji based on different mechanisms, which possibly include

right hemisphere more than left. It could be less conflict in between perception of color and Kanji, that's why consequently we can see less interference in case with colored Kanji reading.

**Conclusion**

In accordance with results of first part of present research we can summarize that using of Kanji symbols may have an effect on perception in general. It could be concluded that Kanji has different mechanism of processing in compare with Hiragana because of right hemisphere involvement.

Following the results of Videotape task we can see better processing of pictures, than both kind of symbols: we can assume that it's because of more developed right hemisphere, but to make more clear conclusion we should make a research on Russian sample to compare.

I want to express my gratitude to Keikan Laboratory of School of Civil Engineering of University of Tokyo for providing participants and very cosy and friendly atmosphere during all research. I am very glad that I had a chance to be member of this lab for a month.

References

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2. Tadanobu Tsunoda (1985). The Japanese brain: Uniqueness and Universality.