Comprehension of Concrete and Abstract Action-Sentence

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Many previous studies show the action-sentence compatibility effect; action-sentences activate our sensorimotor information and lead us to commit actions (Borreggine & Kaschak, 2006; Glenberg & Kaschak, 2002; Nishio, 1995). If sentence comprehension includes the spatial images, our sensorimotor information affects our actual and automatic actions. In this research, we investigate the types of action-sentence: concrete action-sentence and abstract action-sentence. Gibbs and Colston (1995) and Lakoff (1987) state that abstract concepts and their roots are based on experiential and perceptual information. If these hypothesis is collect, the comprehension of abstract action-sentence based on spatial images (e.g. To respect someone is UP) also leads the action-sentence compatibility effect.

Method

Materials The materials used were 36 Japanese sentences. Each sentence included three different spatial images: 12 UP, 12 DOWN, and 12 CONTROL (horizontal) image sentences. These image data were chosen from Taira, Nakamoto, & Kusumi (2006). The material sentences were divided into two types: concrete action-sentences and abstract action-sentences. All sentences were recorded by an experimenter speaking in a natural intonation and saved as wav sound file.

Procedure The experimental trial consisted of three parts: a Sentence Comprehension Task (SCT), a Stimuli Identification Task (SIT), and a Meaning Judgment Task (MJT). When the SCT commenced, the fixation mark (+) appeared on the center of the PC display after 1000 ms, and the target sentence was heard from the headset. The sentence was presented word by word in Japanese with intervals of 500 ms between words (e.g., "The athlete/lifted/the barbell"). In this task, the participants were instructed to listen and understand the target sentence while watching the fixation mark.

The SIT began 50-150 ms after the SCT ended. In the SIT, a circle (○) or a square (□) was presented in the upward or downward area relative to the fixation mark (the visual angle was ± 7 degrees), and the participants were required to determine which figure appeared, as quickly as possible. We collected the decision time data in the SIT: this data shows the activation index of the spatial image from the target sentence.

The other sentences were presented on the center of the PC display after the SIT ended. The sentences only shared verbs with the sentences in the SCT (e.g. "A section manager lifted his boss."). The participants were required to judge whether the meaning of the verbs in SCT and the meaning of the verbs in this MJT was same.

Participants Twenty-four undergraduates and students participated in the experiment as a partial fulfillment of course requirements. They were native Japanese speakers.

Results

The mean accuracy rate of the SIT was 98%. The SIT decision time data (excluding the data of figure misidentification and the data exceeding two standard deviations from the mean) was analyzed by using a two-way ANOVA (Sentence image: UP vs. CONTROL vs. DOWN x Stimulus position: UP vs. DOWN). Table 1 shows the results of the mean decision time in each condition.

Table 1: Mean decision times of concrete and abstract action-sentences by sentence image and stimulus position (ms).

Stimulus Position	Sentence Image		
	UP	CONTROL	DOWN
Concrete Action Sentence			
UP	510	532	534
DOWN	533	515	503
Concrete Action Sentence			
UP	528	527	516
DOWN	512	514	505

The interaction between the sentence image and stimulus position was significant ($F(2, 46) = 7.547$, $p < .005$). Ryan's multiple comparison procedure revealed that the UP image sentences facilitated the participants to execute the identification task of the UP direction faster than that of the CONTROL and DOWN image sentences (UP vs. CONTROL: $t(23) = 2.292$, UP vs. DOWN: $t(23) = 2.498$, *ps* $< .05$). The DOWN image sentences also facilitated the participants to execute the identifying task of the DOWN direction faster than CONTROL and UP image sentences (DOWN vs. CONTROL: $t(23) = 1.797$, $p < 0.1$ DOWN vs. UP: $t(23) = 3.075$, $p < .05$).

On the other hand, the results pertaining to abstract action-sentences revealed no interaction between the sentence image and stimulus position ($F(2, 46) = 0.060$, *n.s.*), and only the main effects of figure position ($F(1, 23) = 5.036$, $p < .05$). Thus, we could not observe the effects of the sentence images.