The Structure of Linguistic Spatial Representation
A test for psychometric structure using Japanese spatial terms

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Introduction

Although it is not clear whether our system of spatial representation as a whole (integrated spatial representation) is structured initially by perception or by language, it is certain that forms of spatial representation generally are ultimately based largely on perception, especially on vision, and on language. Furthermore, when we encode or categorize forms of spatial representation, we do so following systematic rules that are founded on the structures of spatial representation formed by vision, language and so on.

The question remains, then, whether these spatial structures resemble each other? If so, are they grouped in any way? In addition, do they connect with each other, and, if they do, what is the nature of the relation between the specific spatial representational structures formed by vision and by language? According to Hayward and Tarr (1995), the spatial structure encoded by language (e.g., above, below) seems to be based on, and to correspond to, the spatial representational structure based on perception. Crawford, Regier and Huttenlocher (2000), however, have insisted that these structures do not correspond.

Both Hayward and Tarr (1995) and Crawford et al (2000) examined this issue from the viewpoint of categorical prototype and boundary. In linguistic spatial categorization, prototypes and boundaries are dependent on what spatial terms are used. Therefore, their method is not appropriate for comparing spatial structures.

In this study, instead of prototypes and boundaries, we examined fit patterns for four Japanese spatial terms (*ue, shita, hidari, migi*) using Thurstone's law of comparative judgment (case V). From this fit distribution and the prototypical spatial structure of visual representation (Huttenlocher , Hedges, and Duncan, 1991), we investigated whether the spatial structure of perceptual representation corresponds to that of linguistic representation.

Method

Ten Japanese graduate and undergraduate students participated. Stimuli were generated by an IBM/PC compatible computer and presented on a CRT at a viewing distance of approximately 115cm. For each trial, an instruction word would first appear in the center of the screen for 1000ms. Then, a black square (11°×11° side) was centered as a reference object, and two black dots (0.12°×0.12° diameter) were randomly presented as target objects, occupying 21 fixed locations that were based on a former experiment (Kojima & Kusumi, 2002). Four Chinese characters ( ), each of which expresses spatial locations (e.g.," (*ue*)" in Japanese is nearly equal to "above" in English, and, in the same way, " (*shita*)" to "below", " (*hidari*)" to "left" and " (*migi*)" to right) were used as the instruction words in a square (11°×11° side). The participants were required to compare the locations of the two dots in relation to the reference object, and to choose the dot that best suited the location expressed by the prior instruction word.

Results and Discussion

The paired comparison data were processed and scaled by Thurstone's law of comparative judgment (case V). The fit patterns of the four Japanese spatial terms are shown in Fig1, based on scaled value. Here, the width and depth are equivalent to the horizontal and vertical frame lines on the CRT. The height expresses the scaled value (from –3.00 to 3.00). This fit pattern differs from that of the prototypical structure; It shows a less simple gradient pattern.

From this pattern and former studies' result (Huttenlocher et al, 1991), we supported the suggestion of Crawford et.al (2000). That is, we also found that the structure of visual spatial representation does not correspond to the structure of linguistic spatial representation.

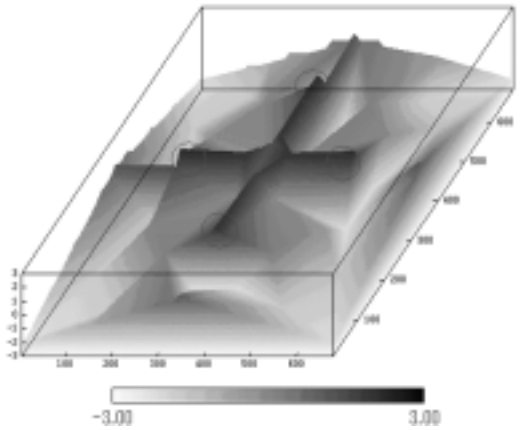

Figure 1:The fit pattern of four Japanese spatial terms

References

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