Abstract of Doctoral Thesis

Title: The mechanism underlying the Mona Lisa effect: The relationship between binocular disparity and pictorial cues

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The gaze direction and face orientation of a person depicted in a portrait painting appears to follow observers when they move around. This is called the Mona Lisa effect. The binocular disparity from the surface of portrait indicates the slant of picture surface, but pictorial cues from the face (relative positions and occlusions between facial parts) indicate the face is facing straight to the observer. Binocular disparity is often considered as the most reliable cue and has priority over pictorial cues in depth perception. However, the functions of these seem inhibited by pictorial cues in such occasions. In this study, the author investigated the relationship between the disparity and pictorial cues when the Mona Lisa effect involving face orientations occurs.

In Chapter 2, the author examined the effectiveness of the perceived facial width in slanted portrait as an measure of the Mona Lisa effect. The width of the face of the retinal image of depicted person appears narrower when the portrait is rotated. The shape constancy should work and the veridical width should be recovered in these occasions. The shape constancy refers that the perceived shape of slanted object remains veridical even if retinal shape of that is distorted. In general, shape constancy occurs based on slant information of object and prior knowledge about object shape. For human faces, shape constancy operates only with slant information because the constraints from knowledge about typical shape of the face is weak. Therefore, if depicted faces are perceived narrower than veridical face, it indicates that the Mona Lisa effect occurs, and if the faces are perceived having the same width as veridical one, it indicate that Mona Lisa effect does not occur. The results showed that the perceived width of the face followed the width of the retinal image created by slanted pictures, and these results indicate that the subjective width is effective for estimating the strength of the Mona Lisa effect.

In Chapter 3, the author examined in detail the effect of binocular disparities contained in each

of the three components of portraits (background, frames, and face) on the occurrence of the Mona Lisa effect, and found that disparity in the background did not have any effect on the occurrence of the Mona Lisa effect, and that disparity contained in the picture frame and the face itself cannot be effective without the existence of frame's pictorial cue.

In Chapter 4, the author examined the role of the "faceness" (the degree an object looks like a face), and found that faces with lower faceness produce weaker Mona Lisa effect. These results suggest that pictorial cues from relative positions and occlusions between facial parts (nose, eyes or mouth) have dominant role in perceived face orientation.

In Chapter 5, the author investigated the Mona Lisa effect (orientation invariance) on depicted objects and spaces. The author found that orientation invariance is weaker for spaces between objects than for regular objects. These results suggest that regular Mona Lisa effect is stronger with objects rather than space.

The author demonstrated that, when the Mona Lisa effect occurs, the functioning of binocular disparity was suppressed by the existence of explicit pictorial cues. The present results, as a whole, suggest that the roles of binocular disparities in the integration process of different depth cues is weaker than has been acknowledged.