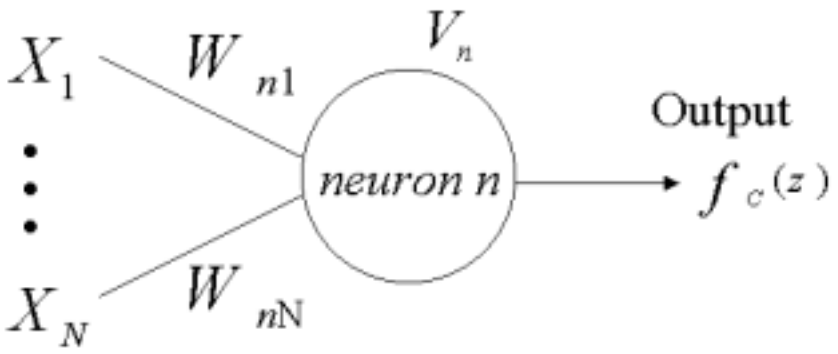
Figure 1: A model neuron used in the Complex-BP Algorithm. X_m, Y_n, V_n, W_{nm}, z and $f_C(z)$ are all complex numbers.



$$Y_n = \sum_m W_{mn} X_m + V_n = z$$

Figure 2: Average of learning speed (a comparison between the Complex-BP and the Real-BP) (Experiment 1).

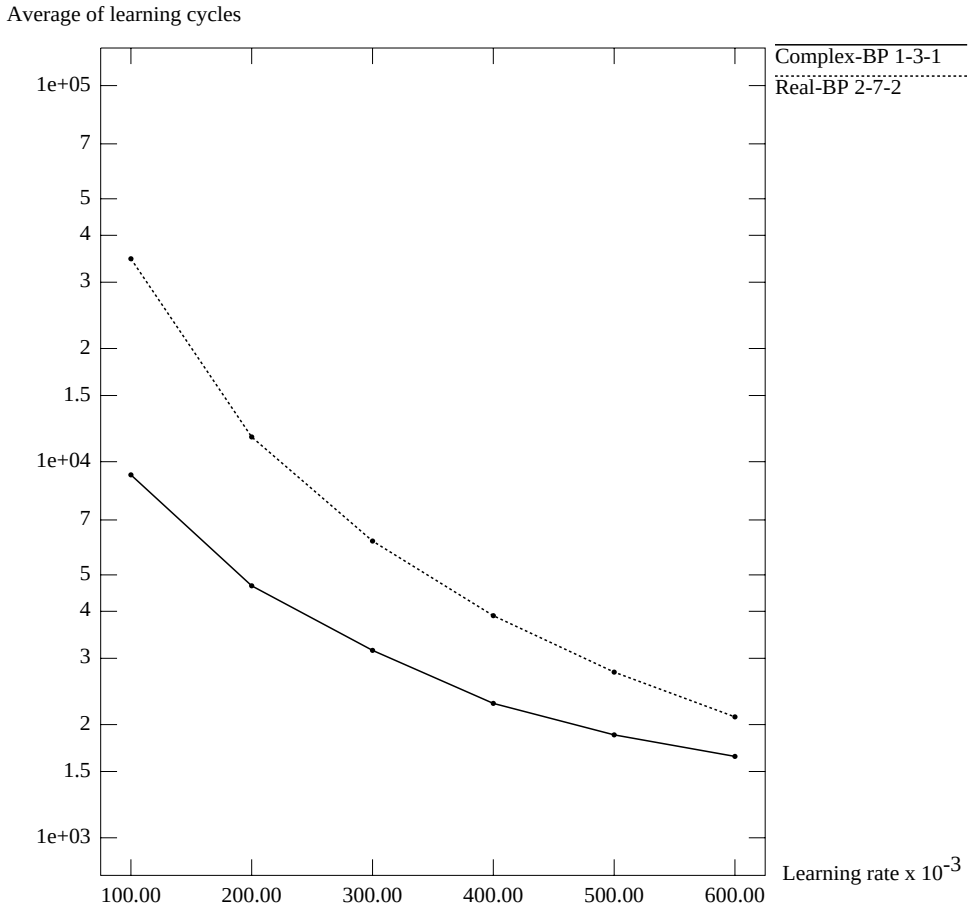


Figure 3: Average of learning speed (a comparison between the Complex-BP and the Real-BP) (Experiment 2).

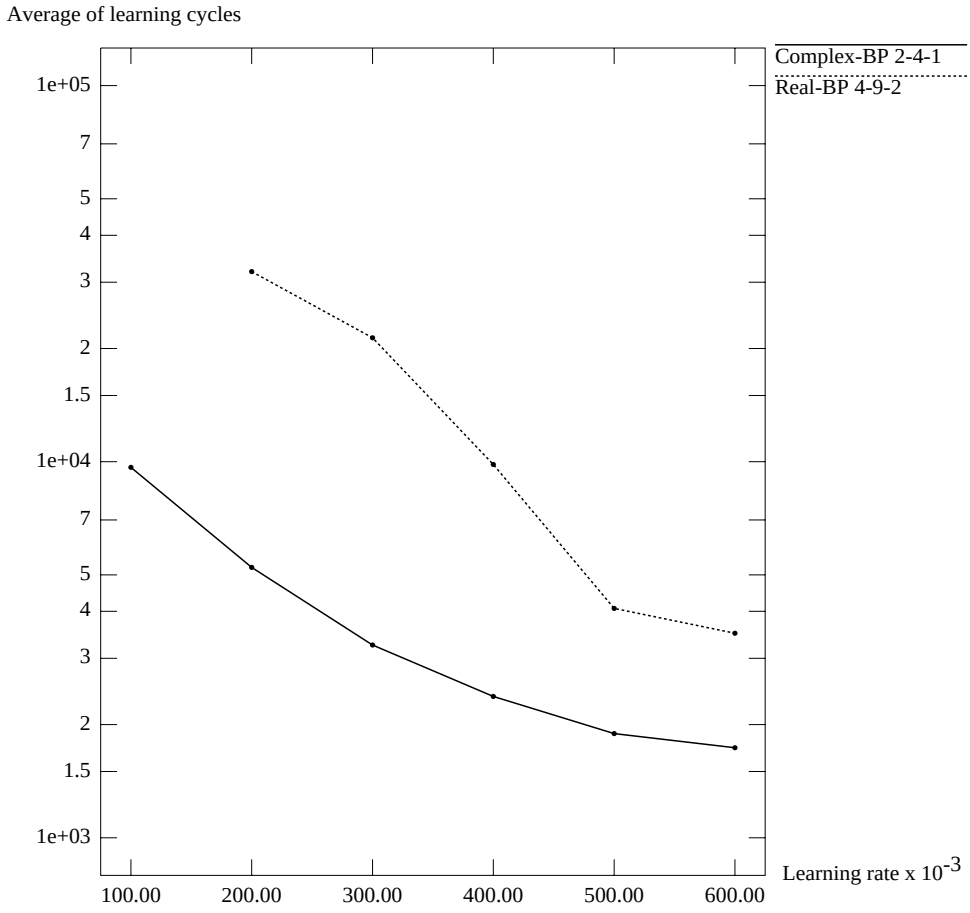


Figure 4: Learning and test patterns for the comparison of the generalization performance of the Complex-BP and the Real-BP [Experiment 1]. A black circle denotes an input training point, a white circle an output training point, and a black triangle an input test point. (a) Input training points. (b) Output training points. (c) Input test points.

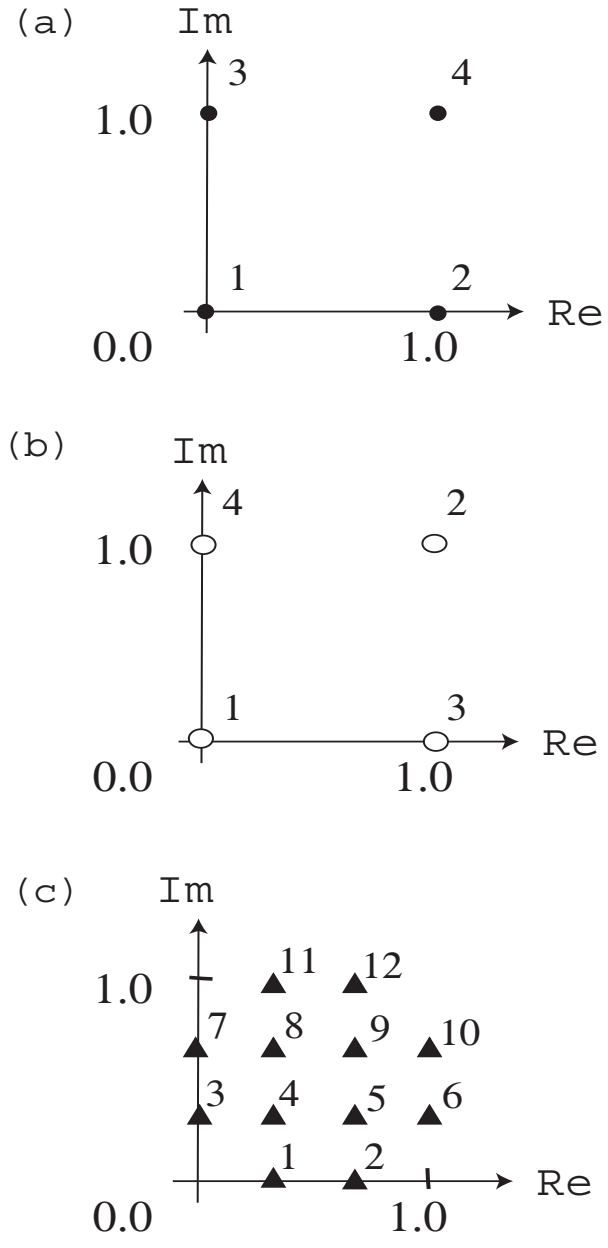


Figure 5: Result of the comparison of the generalization performance of the Complex-BP and the Real-BP [Experiment 1]. A white square denotes an output test point generated by the Complex-BP, and a black square an output test point generated by the Real-BP. (a) Complex-BP. (b) Real-BP.

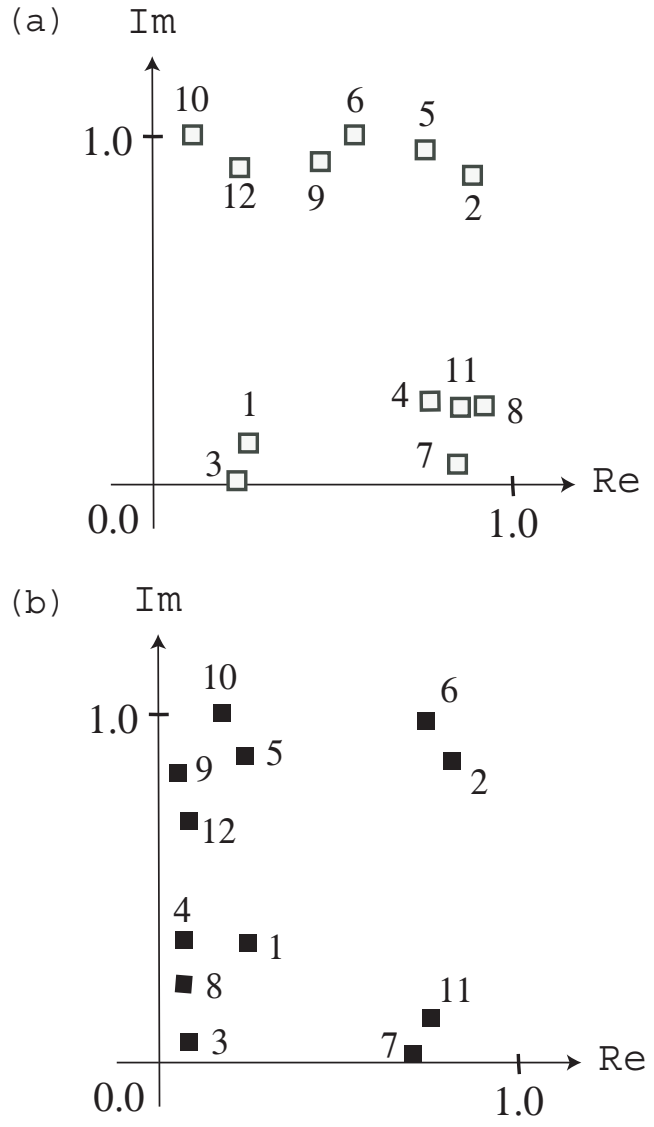


Figure 6: Learning and test patterns for the comparison of the generalization performance of the Complex-BP and the Real-BP [Experiment 2]. A black circle denotes an input training point, a white circle an output training point, and a black triangle an input test point. (a) Input training points. (b) Output training points. (c) Input test points.

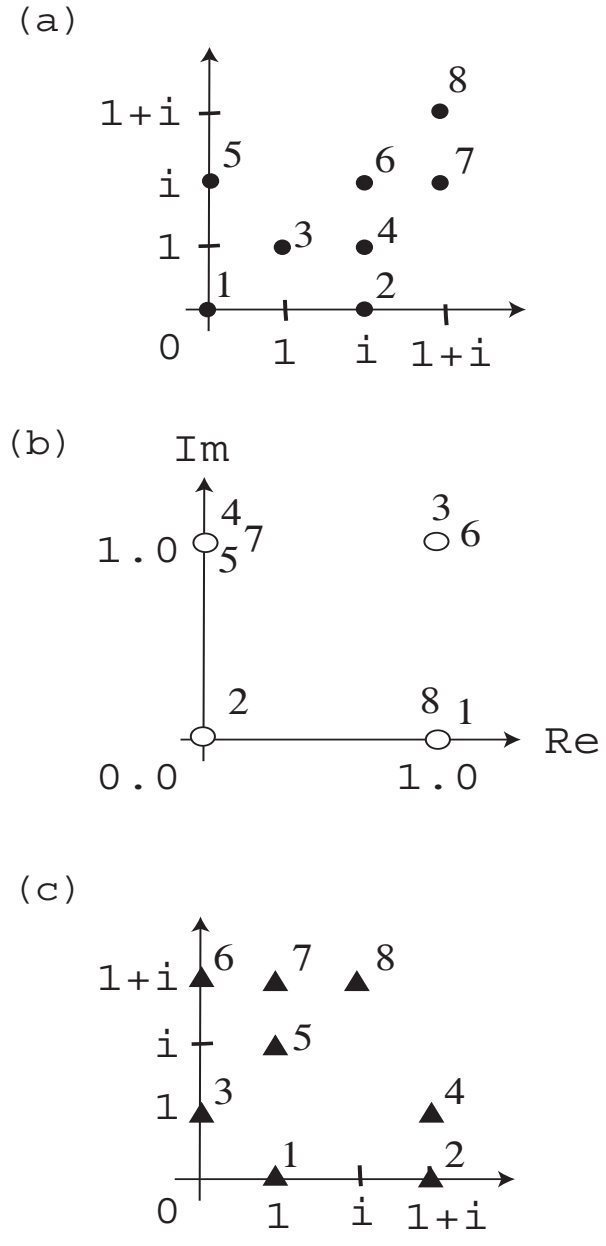


Figure 7: Result of the comparison of the generalization performance of the Complex-BP and the Real-BP [Experiment 2]. A white square denotes an output test point generated by the Complex-BP, and a black square an output test point generated by the Real-BP. (a) Complex-BP. (b) Real-BP.

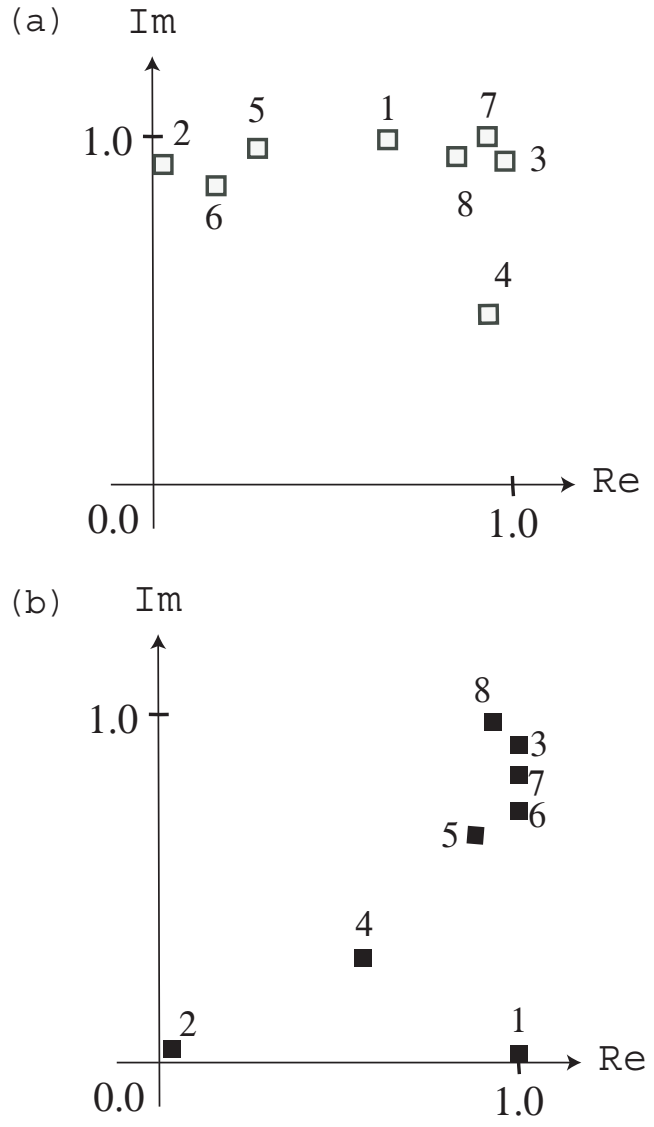


Figure 8: Rotation of a straight line. A black circle denotes an input training point, a white circle an output training point, a black triangle an input test point, a white triangle a desired output test point, a black square an output test point generated by the Real-BP, and a white square an output test point generated by the Complex-BP. (a) Case 1. (b) Case 2.

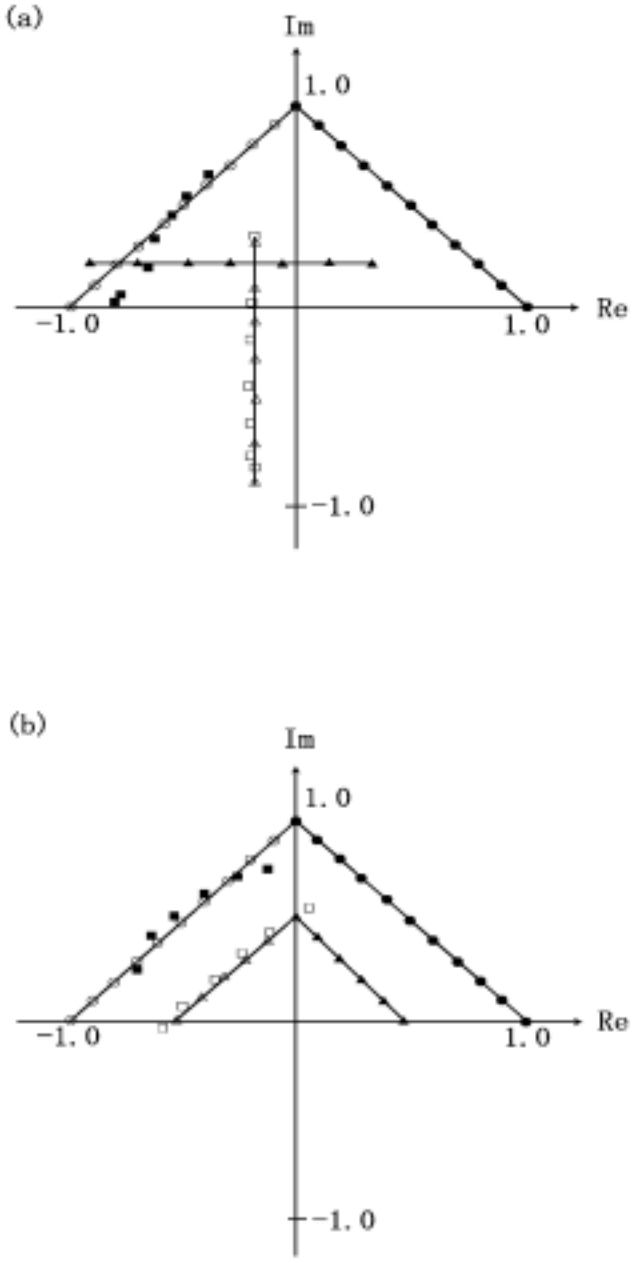


Figure 9: Rotation of the word ISO. The circles, triangles, and squares (black or white) have the same meanings as in Fig. 8. (a) Learning pattern I. (b) Test pattern S. (c) Test pattern O.

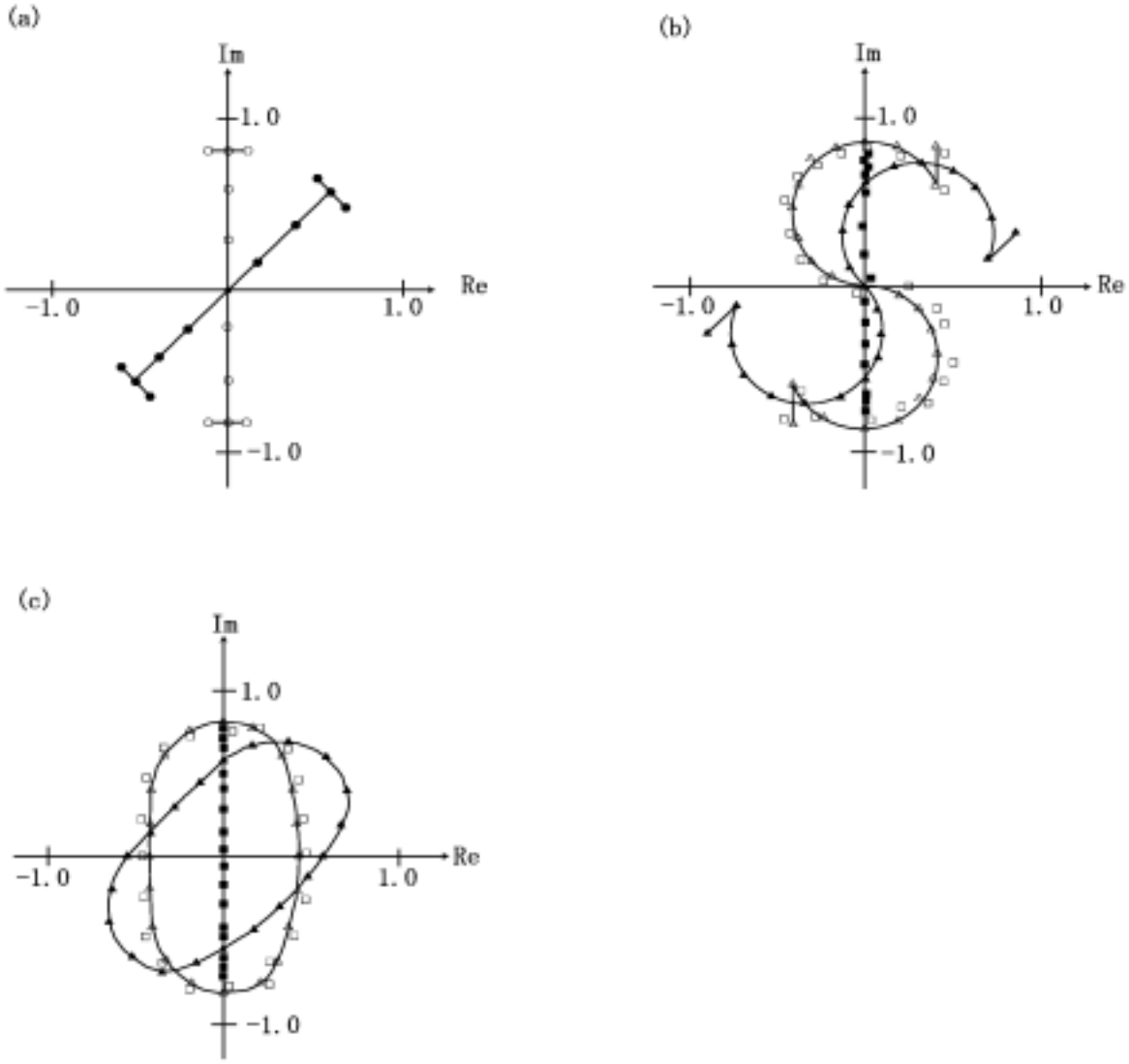


Figure 10: Similarity transformation. The circles, triangles, and squares (black or white) have the same meanings as in Fig. 8. (a) Reduction of a circle. (b) Reduction of a curved line. (c) Magnification of a square.