Structural alignment can facilitate rapid learning of spatial concepts in informal settings [Gentner/Levine/ Chicago Children's Museum]

How can we help children learn spatial concepts? Previous research has shown structural alignment is a powerful tool in helping both children and adults learn novel spatial relations (Christie & Gentner, in press; Gentner & Namy, 1999; Kotovsky & Gentner, 1996). Our goal in this project was to test whether these ideas could be applied to support children's learning of mechanical principles. To do this, SILC partnered with the Chicago Children's Museum to investigate whether structural alignment can facilitate the acquisition of stable construction principles: specifically, diagonal bracing (a subcase of the general principle that triangles confer stability in construction). This study also drew on our prior findings that *alignable differences*—differences that relate to the common structure between a pair—are particularly salient (Gentner & Sagi, 2006; Markman & Gentner, 1993). In this study, children were presented with pairs of model buildings; one building was made with diagonal braces which gave the structure stability and the other had horizontal crosspieces which provided no structural support. There were two training groups: high-alignability [HA] and low-alignability [LA], which differed according to whether their pairs were highly similar and thus easily aligned, or were superficially different, and thus more difficult to align (See Figures 1a. and 1b.) A third group received no training [NT]. During the training, children were shown that the building with the diagonal brace was more stable (harder to wiggle) than the other building.

The predictions were (1) that the two training groups would show better understanding than the no-training group; and (2) that the children in the high alignability group would learn best, because for them the diagonal brace should emerge as an alignable difference, thus helping them focus on how a diagonal brace helps make building stable.

Following training, children and their families built their own skyscraper. Upon completion, children were asked to complete a Brace Placement task to assess their understanding of diagonal bracing. In the Brace Placement task children were presented with an unstable building frame (approximately 1 foot tall) and were asked to help make it more stable by adding a piece to it. We coded the orientation of the child's added piece (with respect to the building's frame) as either diagonal, horizontal or vertical. The results of the Brace Placement task, shown in Figure 2, bear out the predictions. Children who received training generated more diagonal braces than those who did not; and children in the high-alignability condition generated more diagonal braces than those in the low-alignability condition. These findings indicate that the analogical principle of high alignment, shown to be effective in laboratory studies, can be impactful in noisy, real world learning environments.

Figure 1a: High Alignability condition: stable (braced) model on left, unstable model on right

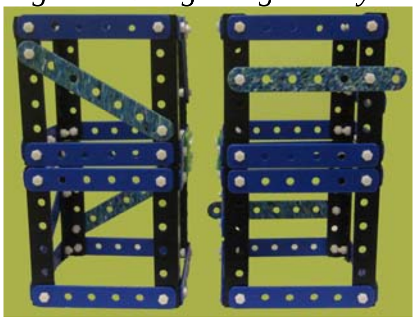
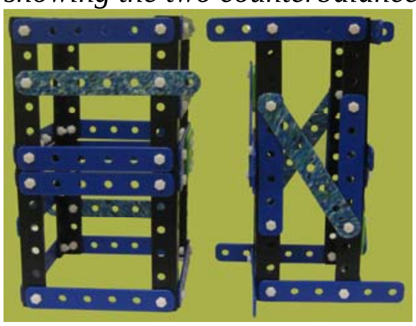


Figure 1b: Low Alignability condition: unstable model on left, stable (braced) model on right, showing the two counterbalanced versions



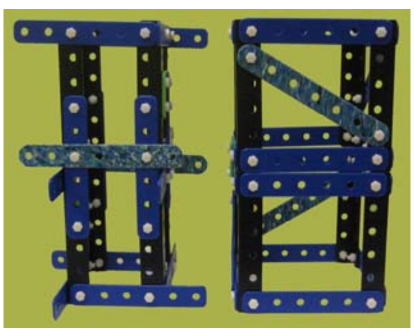
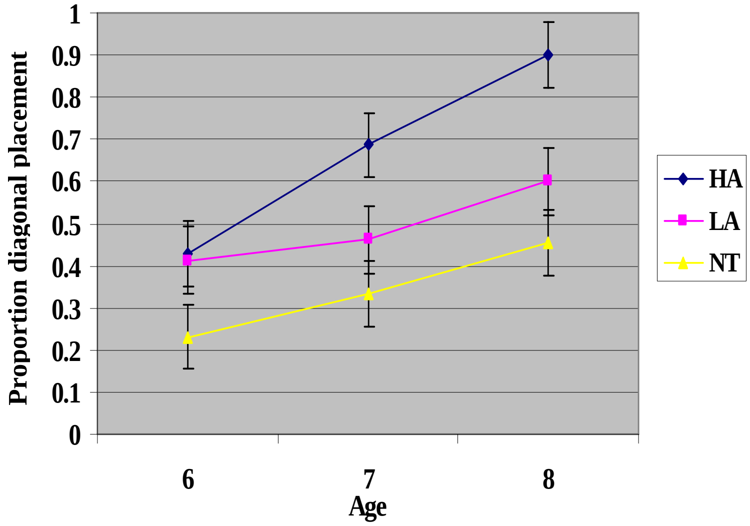


Figure 2: Performance on Brace Placement Task



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