

## **UC Merced**

### **Proceedings of the Annual Meeting of the Cognitive Science Society**

#### **Title**

Near-Miss versus Surface-Different Comparisons in Analogical Learning and Generalization

#### **Permalink**

<https://escholarship.org/uc/item/625540k8>

#### **Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 29(29)

#### **ISSN**

1069-7977

#### **Authors**

Nokes, Timothy J.  
Ross, Brian H.

#### **Publication Date**

2007

Peer reviewed

# Near-Miss versus Surface-Different Comparisons in Analogical Learning and Generalization

**Timothy J. Nokes (nokes@pitt.edu)**

Learning Research and Development Center  
University of Pittsburgh  
Pittsburgh, PA 15260 U.S.A.

**Brian H. Ross (bhross@uiuc.edu)**

Beckman Institute and Department of Psychology  
University of Illinois at Urbana-Champaign  
Urbana, IL 61801 U.S.A.

**Keywords:** analogy, generalization, instruction, individual differences, learning, problem solving, knowledge transfer

A central goal of education and instruction is to promote generalization and transfer so that students can use their knowledge to solve novel problems. Research in cognitive science has shown that making analogies can provide one route to such learning (Gentner, Holyoak, & Kokinov, 2001; Ross & Kennedy, 1990). However, what is learned may depend critically on what types of comparisons are made. Different types of comparisons are likely to facilitate the acquisition of different kinds of knowledge components, which may have important implications for the types of tasks and situations that knowledge transfers to.

The current work tests the hypothesis that two types of comparisons (near-miss vs. surface-varying) would facilitate the acquisition of different components of problem solving skill. Near-miss problems have reversed object correspondences—the same objects play different roles in each problem—and focus the learner on how the variables are instantiated. We predict this learning should help in later *use of the principle*. In contrast, surface-different problems—problems with different content and reversed object correspondences—focus the learner on the fact that multiple contents can be associated with the variables for a given principle, which should help in later *principle access*. Participants learned about statistics principles by making either near-miss or surface-varying problem comparisons and then solved new test problems that assessed their access and use of the those principles.

## Method

Thirty subjects were recruited from the University of Illinois at Urbana-Champaign campus and were compensated \$8 for their participation.

The experiment had a learning phase and a test phase. First, participants learned about four probability principles (permutations, combinations, at least once, and waiting time) by reading worked examples and solving practice problems. In the near-miss condition participants solved practice problems that had the same content as the worked example but with reversed object correspondences. In the surface-different condition participants solved practice problems that had different (but analogous) content as the worked example but with reversed object correspondences. For each participant, two principles were assigned to each learning condition, counterbalanced across participants.

In the test phase participants solved four use and four access test problems (one for each principle). All of the test

problems had new contents and non-obvious object correspondences to the learning problems. The use problems included the appropriate formula and the participant's task was to assign the values from the problem to the correct variables in the formula. The access problems listed the four principle formulae and the participant's task was to choose the correct equation.

## Results and Discussion

Initial analyses of the learning and test data revealed that individual differences in learning interacted with test performance in the two conditions. We split participants into two learning groups (good and poor learners) based on a median split of their overall learning performance on the practice problems ( $M = .84$ ,  $SD = .09$  and  $M = .55$ ;  $SD = .15$  respectively). Table 1 shows the mean performance for each learning group on the use and access tests.

Table 1: Mean use and access scores as a function of learning condition for good and poor learners.

	Use	Access
<b>Good Learners</b>		
<i>Near-miss</i>	.96 (.02)	.91 (.05)
<i>Surface-varying</i>	.93 (.04)	.79 (.06)
<b>Poor Learners</b>		
<i>Near-miss</i>	.90 (.03)	.46 (.09)
<i>Surface-varying</i>	.79 (.08)	.58 (.10)

Inspection of the means shows that the good learners had high performance across all of the tests with slightly lower performance in the surface-varying condition on the access test. In contrast, the poor learners showed an interaction: the near-miss comparisons improved principle use ( $d = .51$ ) whereas the surface-varying comparisons improved principle access ( $d = .32$ ). This interaction suggests it may be helpful to use different comparisons for teaching (poor) students different aspects of how to solve such problems.

## References

- Gentner, D., Holyoak, K. J., & Kokinov, B. N., (Eds.), (2001). *The analogical mind*. Cambridge, MA: MIT Press.
- Ross, B. H., & Kennedy, P. T. (1990). Generalizing from use of earlier examples in problem solving. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 16, 42-55.