

# The Role of Perceptual Concreteness in Analogical Mapping and Transfer

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Abstract ideas are often grounded in concrete representations such as contextualized examples or visual aids. Relatively subtle aspects of these concrete representations affect how the underlying abstraction is learned and transferred to other domains (DeLoache, 1995; Kotovsky & Gentner, 1996). In a study by Goldstone and Sakamoto (in press), participants showed better understanding of a superficially dissimilar transfer situation when the initial learning situation was presented with idealized drawings rather than concrete pictures. Concreteness seems to bind the abstract concepts more tightly to the domain being learned, thereby making transfer difficult. This study examined how concreteness interacts with analogical mapping and transfer.

Participants saw a tutorial on signal detection theory (SDT) embedded in a story about a doctor who is diagnosing patients as "sick" or "healthy" by looking at their cell distortion level. Later on, he finds out which of his patients are actually sick or healthy. In traditional SDT terms, the cell distortion is the stimulus, the diagnosis is the response, and sick and healthy people are signal and noise respectively. Participants saw a presentation of the doctor story with either richly detailed pictures of cells (rich condition) or simple circles representing cells (idealized condition). After taking a tutorial quiz about the doctor situation, the participants were told about a university admissions committee deciding which students to accept or reject on the basis of their SAT scores. Later on, the committee receives feedback on whether these students went on to have good GPAs or bad GPAs at their respective colleges. A transfer quiz was administered to test participants' understanding of the underlying mechanisms of SDT in the university admissions context. After the transfer quiz, the students were told that the two situations are analogous and were asked about their relationship with an analogy quiz.

Although we predicted that the idealized perceptual condition would show an advantage on the transfer quiz, scores from the two conditions showed no significant differences. However, analogical mapping is an important part of transfer (Gentner, 1983; Gick & Holyoak, 1980) and we found that for participants who created poor mappings between the doctor and university situations, perceptual richness had an effect on transfer performance. The idealized cell pictures allowed the incorrect mappers to do as well as the correct mappers on the transfer quiz whereas rich pictures resulted in significantly lower scores on transfer. Without the ability to see the correct mapping, the students in the rich picture condition were not able to do

well on the university transfer quiz. Students who formed correct mappings performed equally well regardless of the level of perceptual concreteness they were exposed to.

The richness of concrete elements also affects how participants map the analogy between the doctor and the university situations. These analogues of SDT have two correct mappings, one using spatial cues to align the components of the analogy and the other using semantic similarity. In the doctor case the cell distortion level increases from left to right and so that *diagnosed as sick* patients are on the right side. SAT scores also increase from left to right and so *accepted students* are also on the right side. Participants in the rich condition were more likely to make these spatial mappings (e.g., *diagnosed as sick* to *accepted students*) than participants who saw the idealized cells. The other equally correct, and perhaps more intuitive, mapping uses semantic cues to align positively characterized components to each other (e.g. *diagnosed as healthy* to *accepted students*) and negative ones to each other. In both perceptual conditions the semantic mapping was more frequently made than the spatial mapping, but being exposed to concrete pictures significantly increases the likelihood of a participant making a correct spatial mapping rather than a semantic one.

These results add to the body of evidence that shows that perceptual concreteness can interfere with transfer performance particularly for students without the proper mapping relations in place. Also, perceptually salient information pushes people to interpret analogies more perceptually (i.e. spatially). Understanding the role of concreteness in learning perceptually presented abstract concepts might help us understand how abstract concepts are generally acquired through grounded experience.

## References

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