Organizing Features into Attribute Values

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The problem of representation change is important for understanding and developing both natural and artificial intelligence. People form new chunks or perceptual units from experience (Schyns & Rodet, 1997) and build up new, continuous, dimensions, (Goldstone, Lippa, and Shiffrin, 2001).

We investigate representation change reorganizing unrelated features into alternative values of the same attribute. For example, 'fins', 'wings', and 'legs' might initially be unrelated properties but people might learn to reorganize them as values of a new attribute, LIMB. Representing properties as attribute values may be importantly different from representing properties as a collection of uncoordinated features, for interpreting novel properties and for projecting inferences.

We investigated perceptually-based attribute formation, in the context of learning about cell-like organisms. We use stimuli where an initial analysis into features is highly available, but there are alternative ways of organizing these features into attributes.

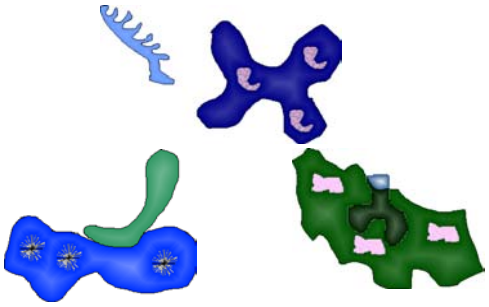

Figure1: Separate, Attached & Overlapping Units

Method

Stimuli were slides of cell-like organisms (*units)*, composed of a larger and a smaller element, each clearly bounded and differently colored. Units varied in the general shape of the larger element, its color, the small figures appearing internal to the larger element (e.g. its 'mitochondria'), and the shape of the smaller element. There were three values of each attribute.

We tried to influence whether participants saw the smaller element as parts of a larger organism versus as a buddy or other accompanying but distinct element, by spatial separation and by order of presentation. We predicted overlapping items would be most ambiguous and interpretation would be influenced by viewing order of Separate, Attached, and Overlapping blocks.

For initial exposure, subjects saw 3 blocks of six 1-unit displays (one block of each type) and described what they saw. Subjects then viewed 18 displays with one to five units ("slides with lower magnification") shown together and indicated how many organisms were on each slide, by circling and counting.

We varied the order subjects saw the Separate, Attached, and Overlapping blocks (Table 1). We expected the first exposure block to be influential. Does exposure order influence the final interpretation of the elements, as values of a new limb-like attribute or as values of a new buddy-like attribute?

Results & Discussion

Table 1 (col. 2) shows that displays had highest counts when subjects first saw the overlapping block, followed by the Attached and then Separated (item analysis $F(3,68)=181.9$). Interestingly, some subjects analyzed the small internal element as a separate organism, particularly in the Overlap First Conditions. Table 2 (col. 3) shows % of displays where subjects counted units all as 1 or all as 2 organisms; Overlap first subjects were less consistent ($F(3,48)=4.8$, $p<.01$)

Table 1

Conditions	Results	
Order of Blocks in Exposure Phase	AveCount /Unit	%consistent count strategy
1:Attach-Overlap-Sep (n=13)	1.75	78 %
2:Sep-Overlap-Attach (n=12)	1.88	81%
3: Overlap-Attach-Sep (n=9)	2.73	29%
4: Overlap-Sep-Attach (n=8)	1.88	60%

Presentation order influenced interpretation of elements as parts or separate organisms. The biggest influence of context came when the ambiguous displays were first. Further work will look at attribute change following concept learning.

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References

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