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Contingency of Parts in Object Concepts

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Contingency of Parts in Object Concepts

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The basic-level is believed to be the most inclusive level of categorisation at which objects look alike in terms of their shape (Rosch, 1978). One determinant of shape is part structure; Tversky and Hemenway (1984) found a sharp increase of listed parts from the superordinate to the basic level, but little rise from the basic to the subordinate level. This was interpreted by Biederman (1987) as a *strong Hardwired Bias for parts* in object recognition. This observed correlation, however, could result from a *Contingent Diagnosticity of parts* for the task.

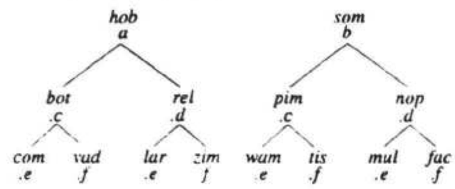

Figure 1. Taxonomy used in our experiment.

Murphy (1991) tested these two rival hypothesis with artificial category hierarchies. He found that basic-levelness was function of the structure of information in these taxonomies rather than their content–corroborating Contingent Diagnosticity and falsifying Hardwired Bias. He has been criticised for having used unnatural objects (Tversky & Hemenway, 1991). The primary aim of this research was to replicate Murphy's results with objects typical of those of Biederman's object recognition studies.

Thirty paid participants learned the category structure of Figure 1.

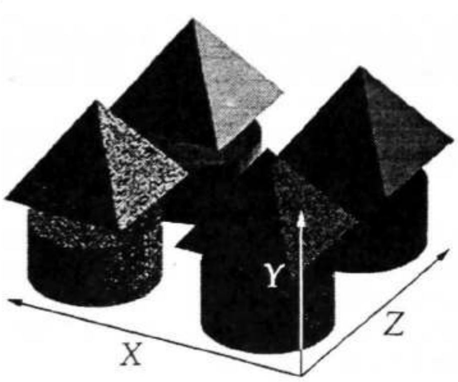

Figure 2. Stimuli used in our experiment.

Eight stimuli filled the whole space defined by three binary dimensions (Figure 2): colour (C) (*X* axis), geon (G) (*Y* axis), and texture (T) (Z axis). One dimension was inserted at every level of the hierarchy of Figure 1. Objects were designed with 3D object modelling software (Form Z).

Participants were equally distributed between three conditions: CTG, GCT, and TGC, where order of letters reflects order of categorisation from high to low.

We used the timed verification task to measure basic-levelness. The procedure of this experiment followed closely that of Murphy (1991). An item began with the presentation of a category name. Participants had to recall the defining feature(s) of the named category. An object was then presented and their task was to decide whether the name and object matched. RTs were recorded.

Means RTs of correct true items (saying "yes" when name and object match) are shown in Table 1.

Table 1: Mean RTs by categorisation levels and conditions.

GROUP	LEVEL		
	lower	middle	higher
CTG	1395.95	1169.49	860.93
GCT	1123.46	918.67	778.34
TGC	1034.00	948.16	818.20
	1184.47	1012.11	819.16

A two-way ANOVA (GROUP x LEVEL) on the RTs revealed a significant main effect of LEVEL, $F(2,54)=12.93$, no effect of GROUP, $F(2.27)=1.07$, $p<.0001$, and no interaction, $F(4,54)=0.89$. Planned comparisons revealed that differences between mean RTs of low- and mid- levels, and mid- and high- levels were significant [$t'D(2,54)=2.33$, sign. diff.>167.48, $p<.05$]. The higher level always yielded the fastest categorisation decisions, and the lower level the slowest, irrespective of part structure (i.e., pro Contingent Diagnosticity, con Hardwired Bias). The error rate was low overall (5.7%) and was positively correlated with RTs ($r=.28$), ruling out a speed-accuracy trade-off. SLIP (Strategies Length & Internal Prolixity) is the only model predicting these results (Gosselin & Schyns, 1997).

This experiment illustrates that the contingent diagnosticity of object cues, rather than hardwired biases for these cues might provide a better account of basic-level performance in object recognition and categorisation.

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