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Unsupervised categorization: Analytic and non-analytic processes

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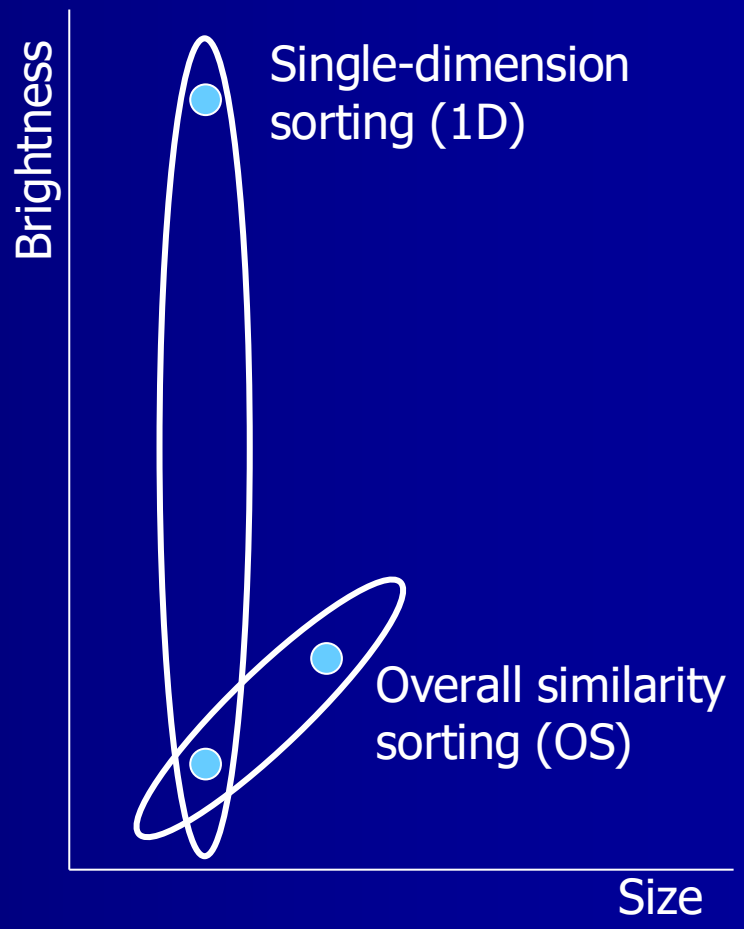
"The child in all of us" (Smith & Kemler Nelson, 1984)

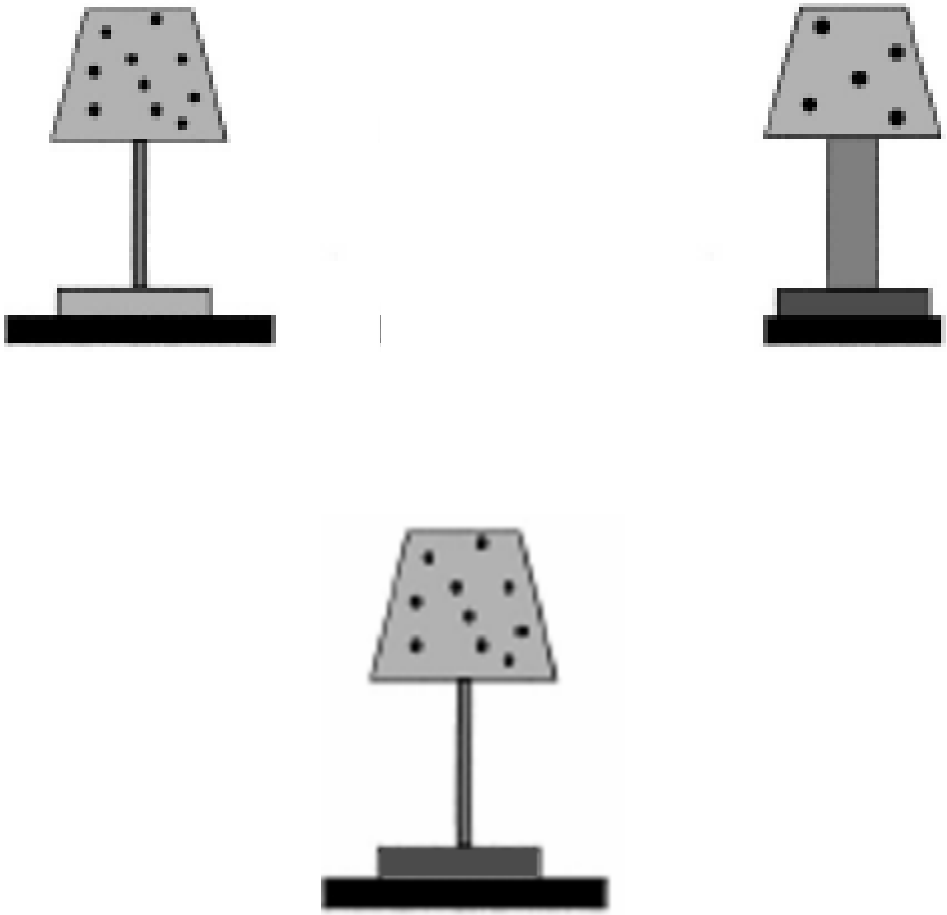
- Adults sort predominately on the basis of a single dimension (analytic, rule-based)
- Children, and adults under time pressure, sort on the basis of overall similarity (non-analytic, similarity-based, "associative")



Status of overall similarity sorting

- Smith and Kemler Nelson (1984) is typical of the general characterisation of overall similarity sorting as non-analytic.
- Recent work on the match-to-standards procedure suggests this characterisation is too simple.

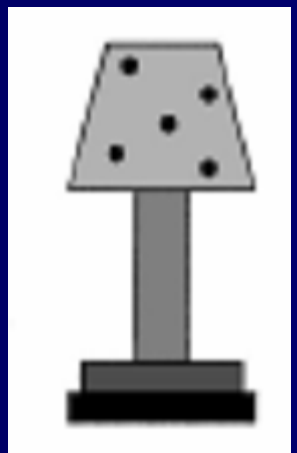
Milton & Wills (2004)
(Regehr & Brooks, 1995)



OS and UD sorting

1 1 1 1

0 0 0 0



Overall similarity

1 1 1 1
0 1 1 1
1 0 1 1
1 1 0 1
1 1 1 0

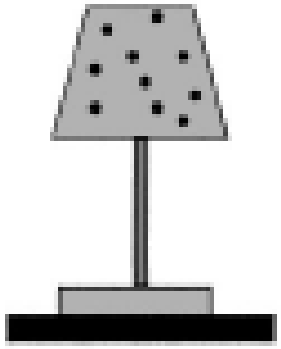
0 0 0 0
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1

Unidimensional

1 1 1 1
1 0 0 0
1 0 1 1
1 1 0 1
1 1 1 0

0 0 0 0
0 1 1 1
0 1 0 0
0 0 1 0
0 0 0 1

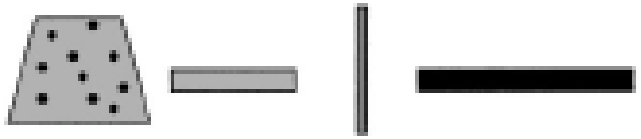
Spatial integration effect
(Milton & Wills, 2004)



OS 9

UD 9

Spatially integrated



OS 13

UD 5

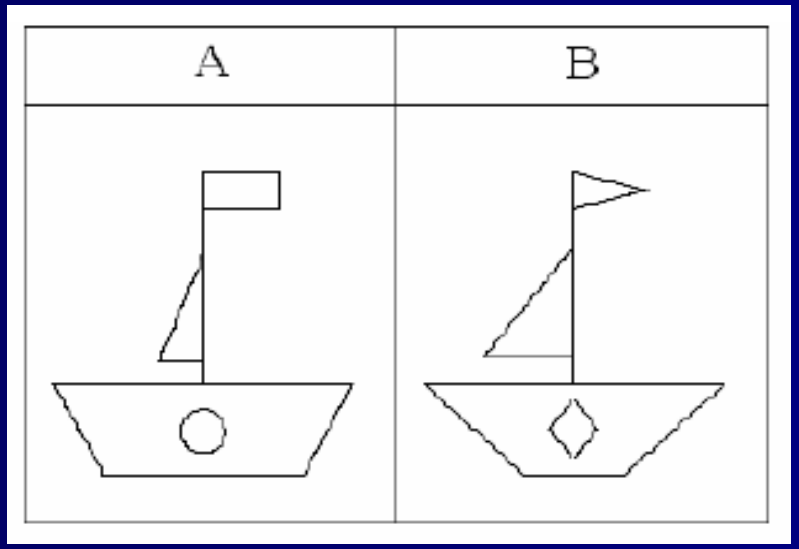
Spatially separate

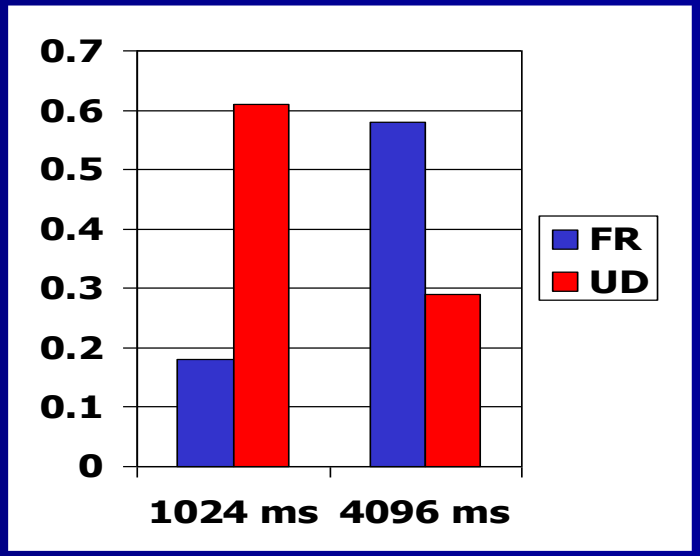
- Opposite to expectations under a "natural-ness" hypothesis
- Opposite to expectations under an intergral/separable hypothesis
- Consistent with the idea that dimensional separation promotes a *dimensional summation* strategy – an analytic process that produces overall similarity sorting.
- Overall similarity sorting can be an analytic process?

Overall similarity sorting can be analytic?

- If so, we should be able to see a reversal of classic triad task manipulations.
- Time pressure
  - Time pressure *increases* OS sorting
  - We should be able to show time pressure *decreasing* OS sorting.
- Concurrent load
  - Concurrent task load *increases* OS sorting
  - We should be able to show concurrent load *decreasing* OS sorting
- Instructional manipulations
  - Non-analytic instructions *decrease* UD sorting
  - We should be able to show analytic instructions *decreasing OS* sorting
- Impulsivity
  - Impulsive people are more likely to produce OS sorts.
  - We should be able to show that impulsive people are more likely to produce UD sorts.
- Working memory capacity
  - We would also predict OS sorters have a higher working memory capacity

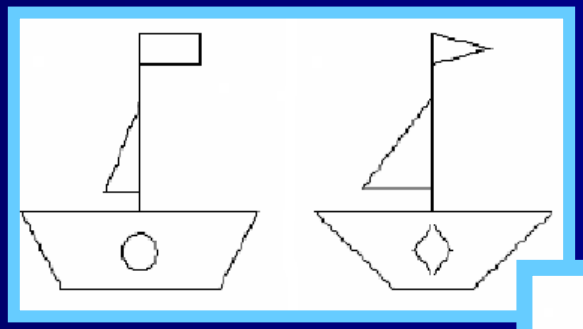
Time pressure

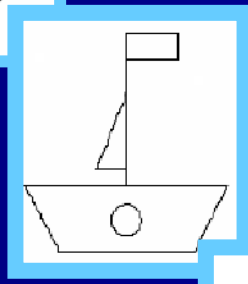




- Presentation time manipulation
- Each participant sorts 12 sets at one time pressure.

Concurrent digit load

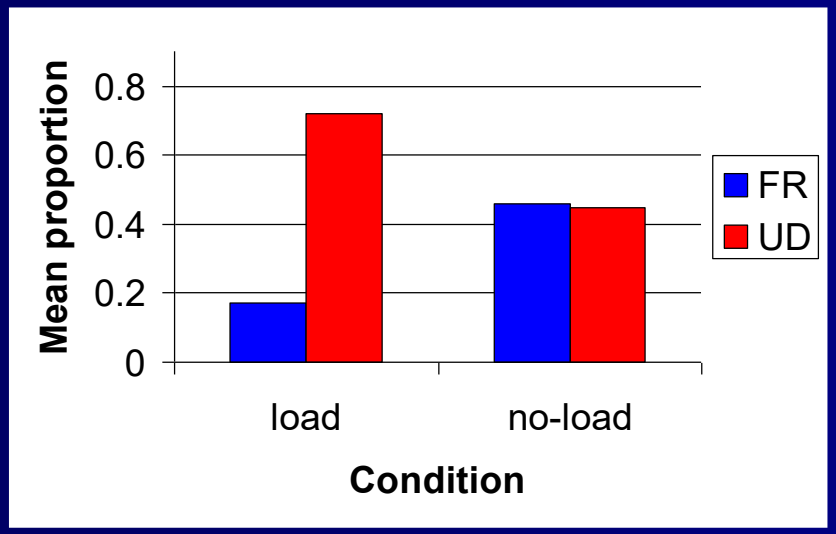




"6 .. 4 .. 9 .. 2 .. 8 .. 1"

A or B?

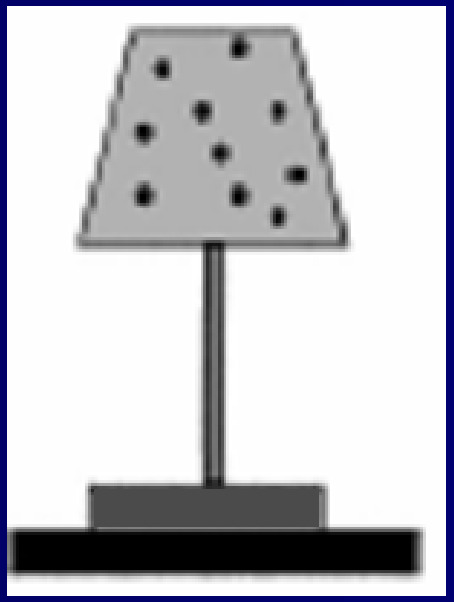
9

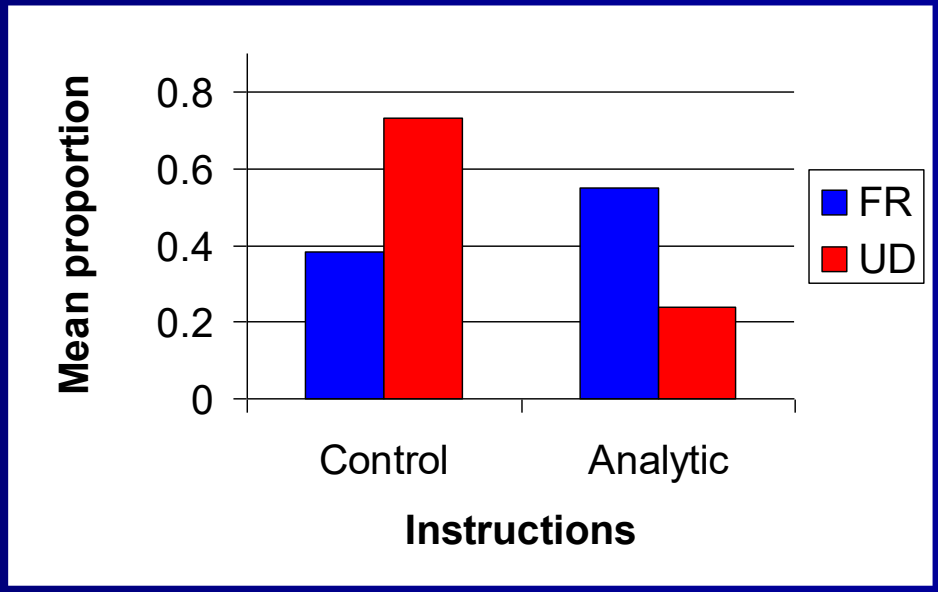


Instructional manipulation

Standard instructions vs. "analytic" instructions:

"The pictures you are about to see are quite complex. You should take particular care in your evaluation of how they differ. Study each image in detail. Be meticulous and careful."



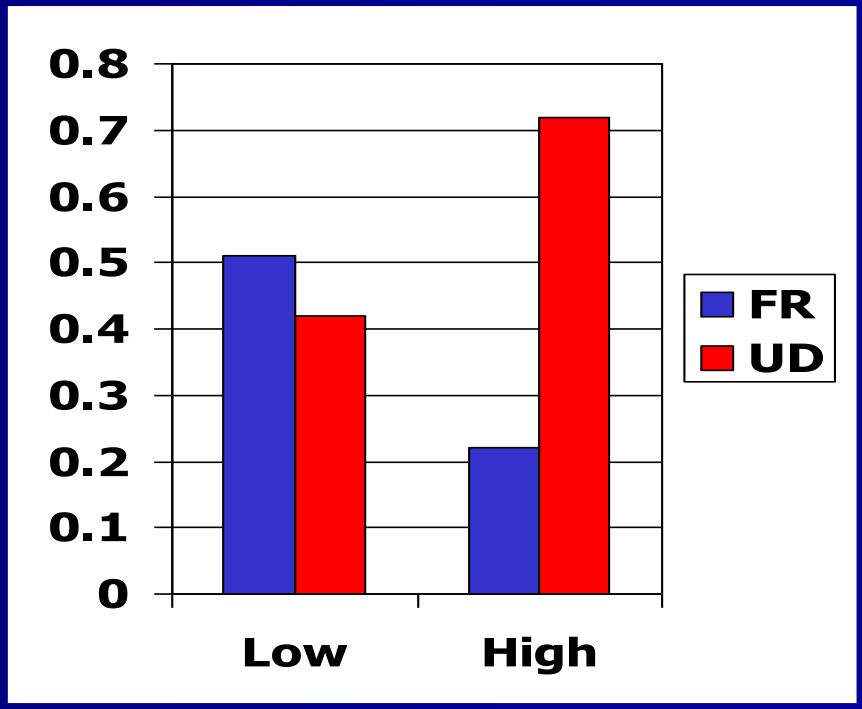


Working memory capacity

- Lampshade stimuli again; this time only sort one set (first sort is where WM demands are likely to be highest).
- "Operation span"
  - Standard measure of working memory
  - Solve equations
  - Each equation is accompanied by a word
  - Recall words in order at the end.
  - Working memory capacity indexed by maximum number of words recalled correctly (span)
- OS sorters OSPAN = 3.7
- UD sorters OSPAN = 2.4

Impulsivity

- Lampshades again.
- Standard impulsivity questionnaire administered at end of experiment.
- Median split of participants on impulsivity score.



Conclusion

- Overall similarity sorting is typically seen as non-analytic / associative; single-dimension sorting is typically seen as analytic / rule-based.
- Such a view is well-supported, and we generally accept those data i.e. no suggestion here that previous results are artifactual.
- Nevertheless, we have strong converging evidence that overall similarity sorting can in fact be more analytic than single-dimension sorting, and…

- … this is perhaps a cautionary tale for anyone who might wish to use type of classification strategy (e.g. UD vs. OS) as an index of the underlying cognitive processes.