How do the salience and strength of existing relational representations impact analogical reasoning ability in children?

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What did we find?

- Children's analogical reasoning ability can be significantly improved by playing a card sorting game prior to completing analogy problems
- We suggest the card sorting game enriched and raised the salience of role-governed category representations for objects in the card stimuli, priming these representations to be recalled when the same objects appeared within subsequent analogy problems
- Children relied less on their existing knowledge to solve analogy problems after role-governed representations had been enriched and made salient through the card sorting game

Background

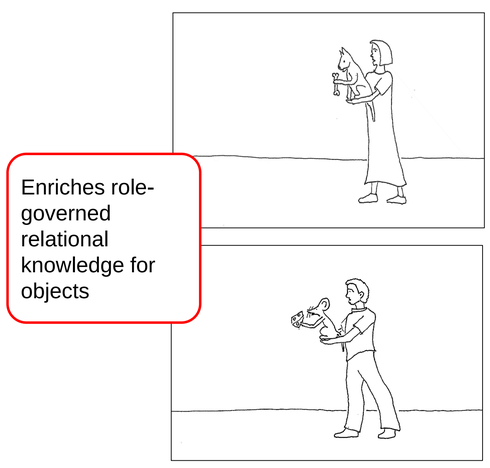
- Role-governed category knowledge is believed to be an important aspect of the relational knowledge required for analogical reasoning[1, 2]
- Role-governed categories refer to an object's *relational* conceptual information (e.g. *eats* and *chases* are role-governed features of a dog, as opposed to intrinsic features such as *four legs, tail* etc.)
- Several lines of research and theory suggest that the knowledge representations invoked by stimuli are determined in part by contextual factors such as current goals and preceding states of cognition[3, 4]
- Categorising images of objects in relational structures should enrich and contextually raise the salience of role-governed knowledge for objects in the category stimuli

What did we do?

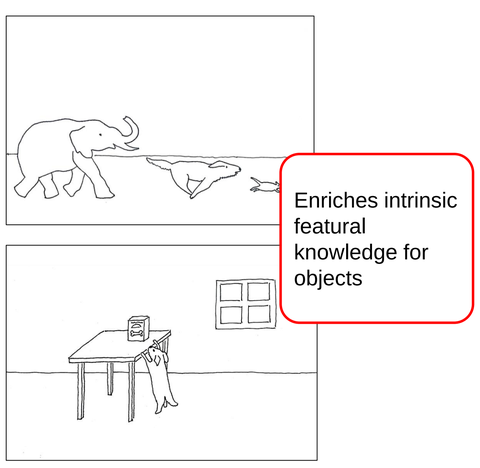
Stage one

- Participants (*n* = 27; mean age = 6y, 1m, *SD* = 0.86m) categorised images into two groups by either *relational structure* or *perceptual features*
- Hypothesis: Categorising the images by relational structure will enrich and prime role-governed representations for objects within the stimuli

Relational category examples
All scenes illustrate *holding*

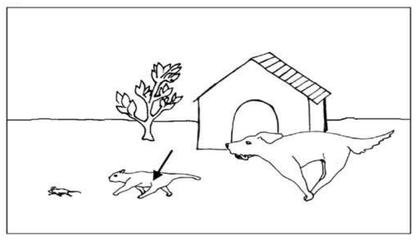


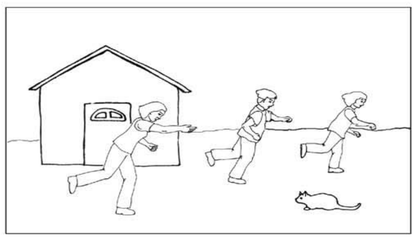
Perceptual category examples
All scenes illustrate a dog



Stage two

- Participants then completed a series of scene analogy problems (created by Richland et al[5]) composed of either a) a *high* number of objects that had featured in the category images or b) a *low* number of objects that had featured in the category images
- Hypothesis: Relational structures will be more visible in analogy problems which have a high object overlap with the category stimuli due to a higher level of primed role-governed knowledge being recalled





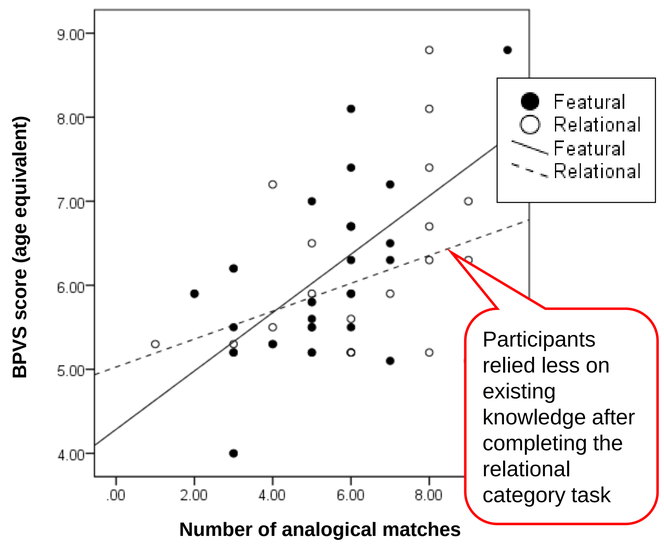
Measuring existing knowledge

- Children's level of existing knowledge was measured using the British Picture Vocabulary Scale III[6]
- Hypothesis: If new category knowledge is formed during the category task, the association between existing knowledge and analogy task performance will be reduced

Did it work?

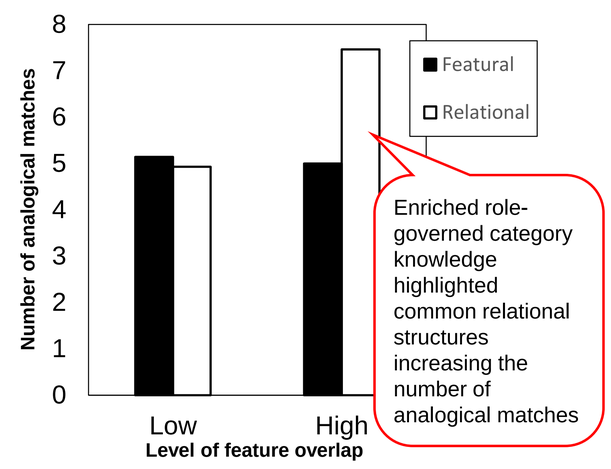
Existing knowledge and analogical reasoning

- Association between vocabulary level and number of analogical matches was significantly lower when participants completed the category task in the relational condition (r = .36, p = .03) compared with the perceptual condition, r = .62, p < .001
- The interaction between vocabulary level and category condition was significant for problems with a high object overlap only, $F(1, 26) = 4.99$, p = .04



Effect of the category task on analogical reasoning

- An ANCOVA analysis revealed a significant interaction between category condition and level of object overlap, $F(1, 26) = 13.75$, p = .001, η_p^2 = .37
- Participants made significantly more analogical matches when there was a high object overlap across the category and analogy stimuli in the relational category condition (M = 7.46, SD = 1.56, p <.001) compared to the featural category condition, M = 5.00, SD = 1.68
- There was no significant difference between number of analogical matches when there was a low level of shared objects across the category and analogy stimuli in the both the relational (M = 4.92, SD = 2.13, p = .72) and featural category conditions, M = 5.15, SD = 2.03



Conclusions

- We suggest that categorising images by their relational structure enriched and raised the salience of role-governed category knowledge for the objects in the images
- Due to having enriched and salient role-governed representations after the relational category task, participants a) relied less on their existing relational representations as indexed by the difference in association BPVS score and number of analogical matches, and b) were primed to see the relational structures in the analogy problems as indexed by increased analogical reasoning performance
- Future work will investigate a) category tasks as a method for contextually-modifying representations and b) translating the category priming paradigm into applied learning methods that rely in part on understanding relational concepts

Further information

References:

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