Towards exploring adaptive and associatively reactive answer strategies to creativity test queries

SPATIAL COGNITION

Ana-Maria Olețeanu, Jonathan B. Dyer

Scope
- Cognitive system series to investigate creative processes;
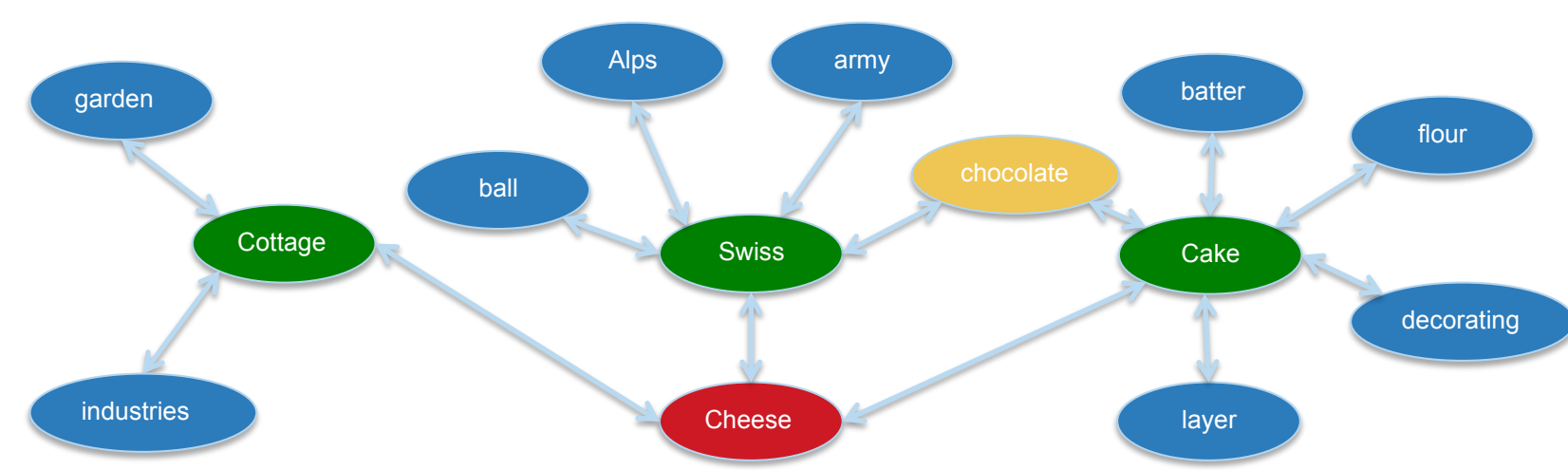- Current focus: adaptive switch strategies; current task: the Remote Associates Test (RAT)

Remote Associates Test (Mednick 1971)
- 3-item problems

    COTTAGE   SWISS   CAKE

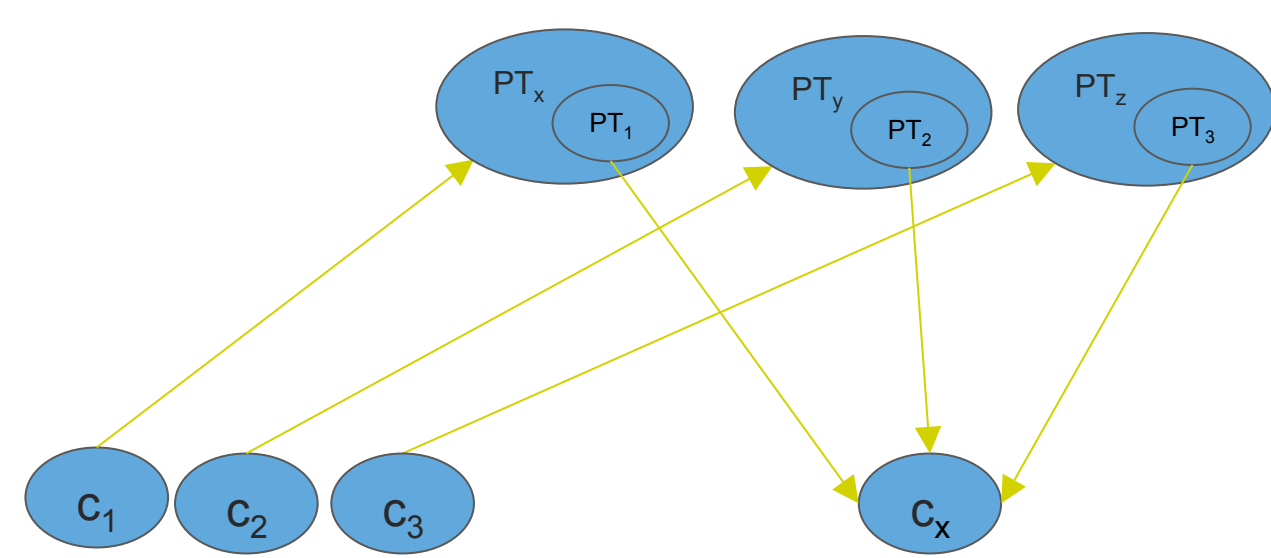- Find a 4th item, common to all

    CHEESE

comRAT-C
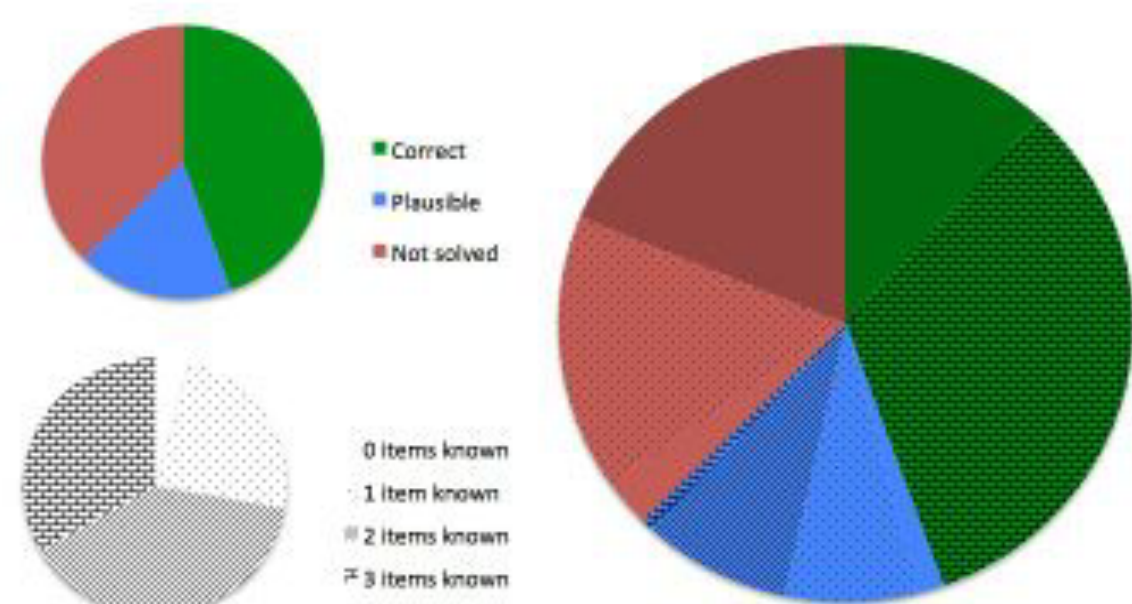- Solves the RAT computationally (Olețeanu and Falomir, 2015)

$$c_1 = falling, c_2 = Actor, c_3 = Dust$$
$$c_4 = ?, \text{so that}$$
$$\exists PT_1 = \{c_1, c_4\}, \exists PT_2 = \{c_2, c_4\}, \exists PT_3 = \{c_3, c_4\}$$

$$PT_1 = Falling\ Star, PT_2 = Star\ Actor, PT_3 = Star\ Dust$$
$$c_4 = Star$$

Accuracy

Answer /items known	0 items	1 item	2 items	3 items	Total
Correct	0	0	17	47	64
Plausible	2	11	12	1	26
Not solved	4	23	27	0	54
Total	6	34	56	48	
Accuracy			30.36%	97.92%	

Plausible answers

RAT Query	Bowden Correct answer	New correct or plausible non-matching answer
French Car Shoe	HORN	COMPANY
Mill Tooth Dust	SAW	GOLD
Change Circuit Cake	SHORT	DESIGN
Cat Number Phone	CALL	HOUSE
Off Military First	BASE	PAY
Child Scan Wash	BRAIN	BODY
Home Sea Bed	SICK	WATER
Cry Front Ship	BATTLE	WAR

compound vs. functional RAT
>= 2 categories of RAT (Worthen and Clark, 1971)
- Functional associates = semantic relationship
    (+/- linguistic relation)

    BIRD & FEATHER   **BLACK & WHITE**

- Structural (compound) associates = linguistic relationship   (compound joint or separate pairs)

    FEATHER & DUSTER   **BLACK & MAGIC**

comRAT-G (Olețeanu, Schultheis, Dyer, 2016)
Generating queries computationally, rather then answering them => advantages for cog. psych: sets of controlled queries
- Built 17 mill. query set – compound noun queries

Strategies observed when the query is hard (both F and P low)
a)   strength of assoc. prevails over convergent proc.

w_1	w_2	w_3	Conv. answer	Actual answer
trophy	eggs	scales	fish $P(w_{ans}|w_1) = 0.1034$; $fr(w_1, w_{ans}) = 33$	case $P(w_{ans}|w_1) = 0.2132$ $fr(w_1, w_{ans}) = 68$

b) answer as if the query is functional +/- >strength

w_1	w_2	w_3	Conv. answer	Actual answer
trophy	eggs	scales	fish $P(w_{ans}|w_3) = 0.1163$; $fr(w_3, w_{ans}) = 47$	weight $P(w_{ans}|w_3) = 0.4797$ $fr(w_3, w_{ans}) = 71$

Low Frequency and Probability, 20 queries, n=24

Correct	Compound	Functional	No Answer	Meaningless
19.71%	29.71% w_1=25.74% w_2= 2.79% w_3= 1.18%	19.71% verified – 13.53% unverified – 6.18%	10%	21%

Conclusion and future work
We observed: Adaptive use of *multiple types* of associates, with strength of association playing an important role (despite clear instruction)

Future work
- Test wider scale with items that can have both functional and compound answers
- Find the threshold where the search mechanisms switched from convergence to being strength of association reliant
- Any visual/linguistic switch?
- Application for robustness of search in computational queries, when not enough knowledge – multi context embedding.

Contact
amoodu@informatik.uni-bremen.de

References

Mednick, S.A. and Mednick, M. (1971) – Remote associates test: Examiner's manual, Houghton Mifflin.

Olețeanu, A.-M. and Falomir, Z. (2015) – comRAT-C – A computational compound Remote Associates Test solver based on language data and its comparison to human performance, Pattern Recognition Letters, 67, 81-90.

Olețeanu, A.-M. , Schultheis, H. and Dyer, J.B. (2016)– Constructing a repository of compound Remote Associates Test items in American English with comRAT-G, in rev.

Worthen, B.R. and Clark, P.M. (1971) – Towards an improved measure of remote associational ability. Journal of Educational Measurement, 8(2), 113-123.

Universität Bremen

DFG Deutsche Forschungsgemeinschaft

University of Pittsburgh