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Breaking Barriers: Emerging Topics in Creativity and Insight Research

Amory H. Danek

14th Symposium of BIAL Foundation, Porto

04.04.2024



Wolfgang Köhler (1887-1967)



Köhler, Intelligenzprüfungen

Tafel IV.

picture from Köhler, 1921

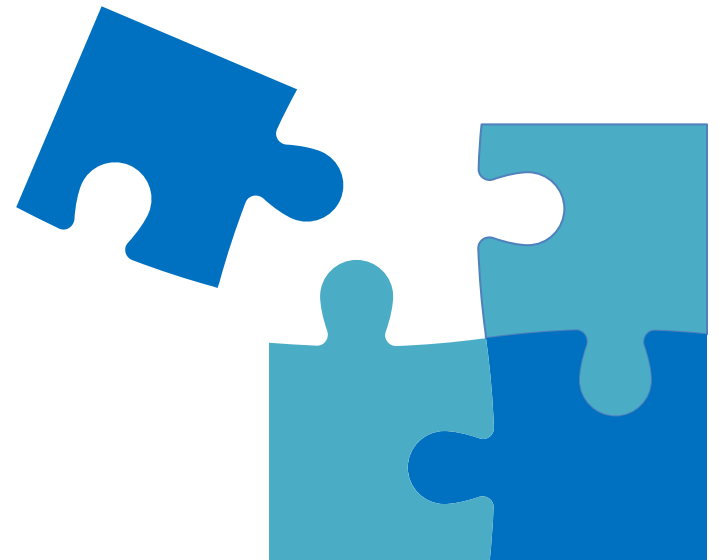
What are „insights“?

“Insights represent cases of problem solving that involve an abrupt shift from bewilderment to clarity, in which a new interpretation emerges that enables everything to fit together.”

Wiley & Danek (2024). Restructuring processes and Aha! experiences in insight problem solving.
Nature Reviews Psychology



Archimedes in the bath



Creative problem solving

How do new ideas emerge?

Can we train this?

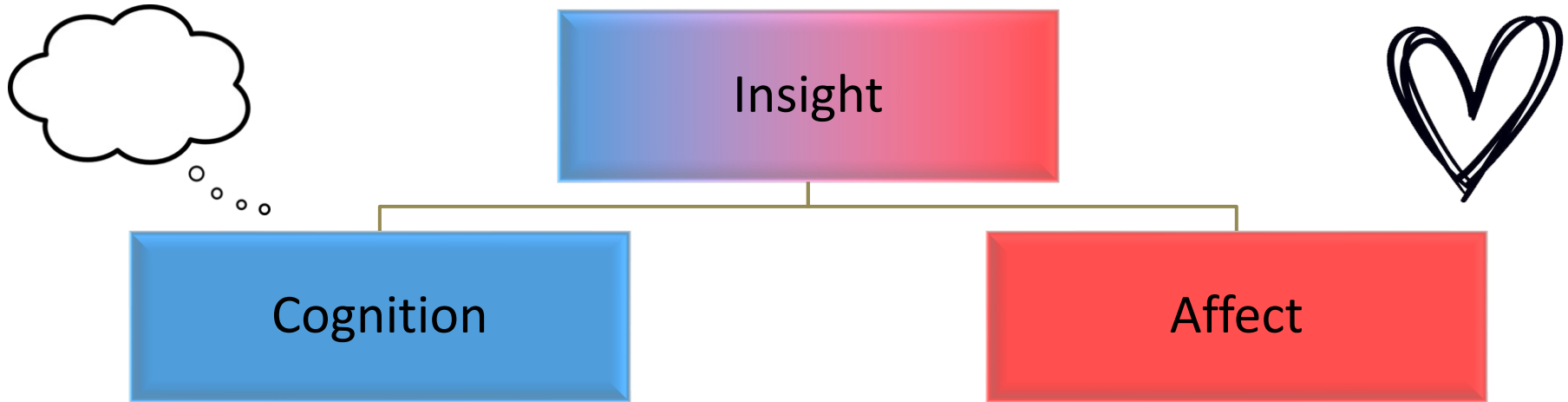


Role of emotions?

Benefits of insight?

How to overcome fixation
and have more insights?

Two components of insight



Restructuring

(Ohlsson, 1984, 1992, 2011)

Initial approach to problem does not work
→ fixation, constraints

Requires fundamental change or
„Umkrempelung“ (Wertheimer, 1925)

→ to break free from fixation,
to relax constraints

Aha! experience

(Bühler, 1908)

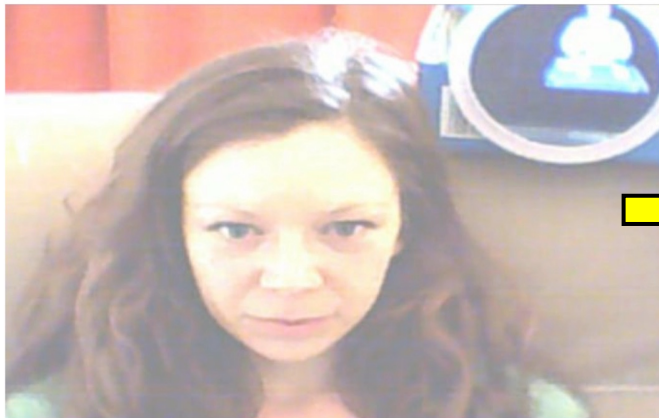
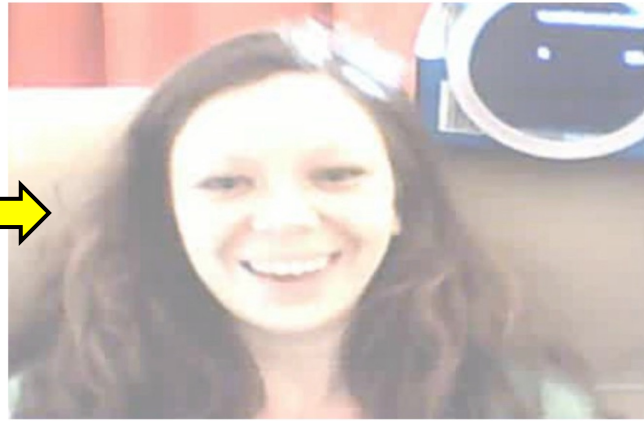
Bundle of emotions: Pleasure,
Suddenness, Confidence
(Danek & Wiley, 2017)

The joy of discovery

before solution

after solution (1 sec later)

Self-report:



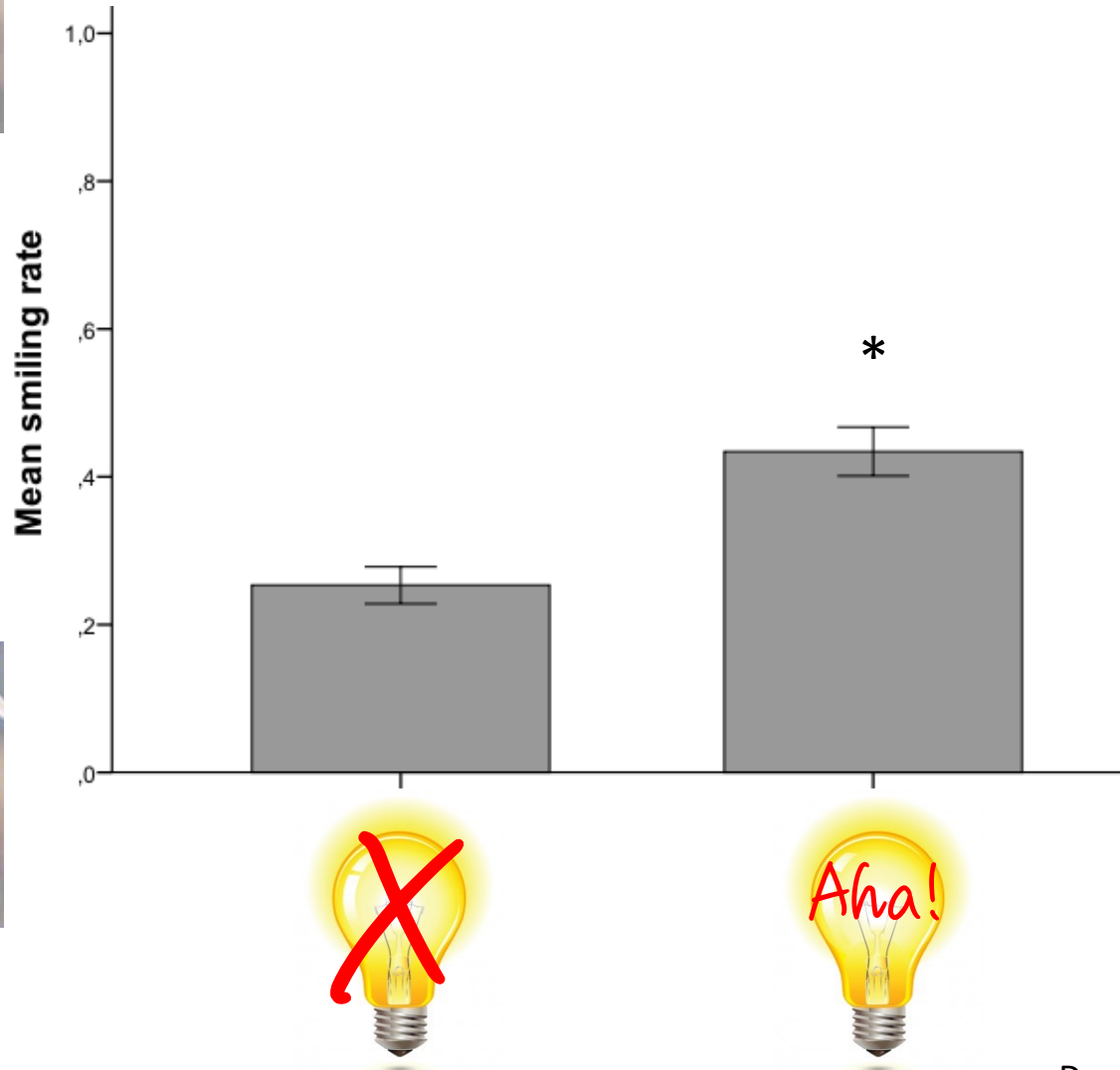
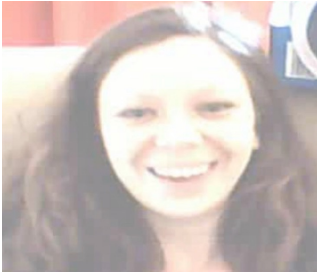
Picture from Danek, A. H. (2018). Magic tricks, sudden restructuring and the Aha! experience: A new model of non-monotonic problem solving. In F. Vallee-Tourangeau (Ed.), *Insight: On the origins of new ideas*. London: Routledge.

Self-report: How does an Aha! moment feel for you?

- „A moment of bliss. I am happy and get into a good mood .”
- „Explosively, the bad feeling of frustration and confusion turns into a feeling of happiness and I feel a swell of pride.
- „I feel that suddenly, I know the solution, thrilled, excited, pleased to have understood something. ”
- „Beautiful. Cool. Surprised by myself”

→ Can we observe this in facial expressions?

The joy of discovery: Smiling rates



Feelings of Aha! are experienced in a variety of contexts

- resolving tip-of-the-tongue states (Metcalf et al., 2017)
- getting a joke (Bianchi et al., 2022)
- making analogical leaps (George & Wiley, 2018)
- understanding mathematical concepts (Barot et al., 2023; Liljedahl, 2005)
- achieving a breakthrough in therapy (Caspar & Berger, 2007)
- ...

→ we return to **creative problem solving** now!

How to make insight tractable in the lab?

Magic Tricks (Danek et al., 2014)



→ prime examples of false problem representations

→ trigger strong Aha! experiences







Science of Magic Assoc.



Conversations on Science, Magic, & Society

Magic & Creativity



Science
of
Magic
Association



Amory Danek,
Psychologist &
Creativity Researcher



Cyril Thomas,
Psychologist & Magician

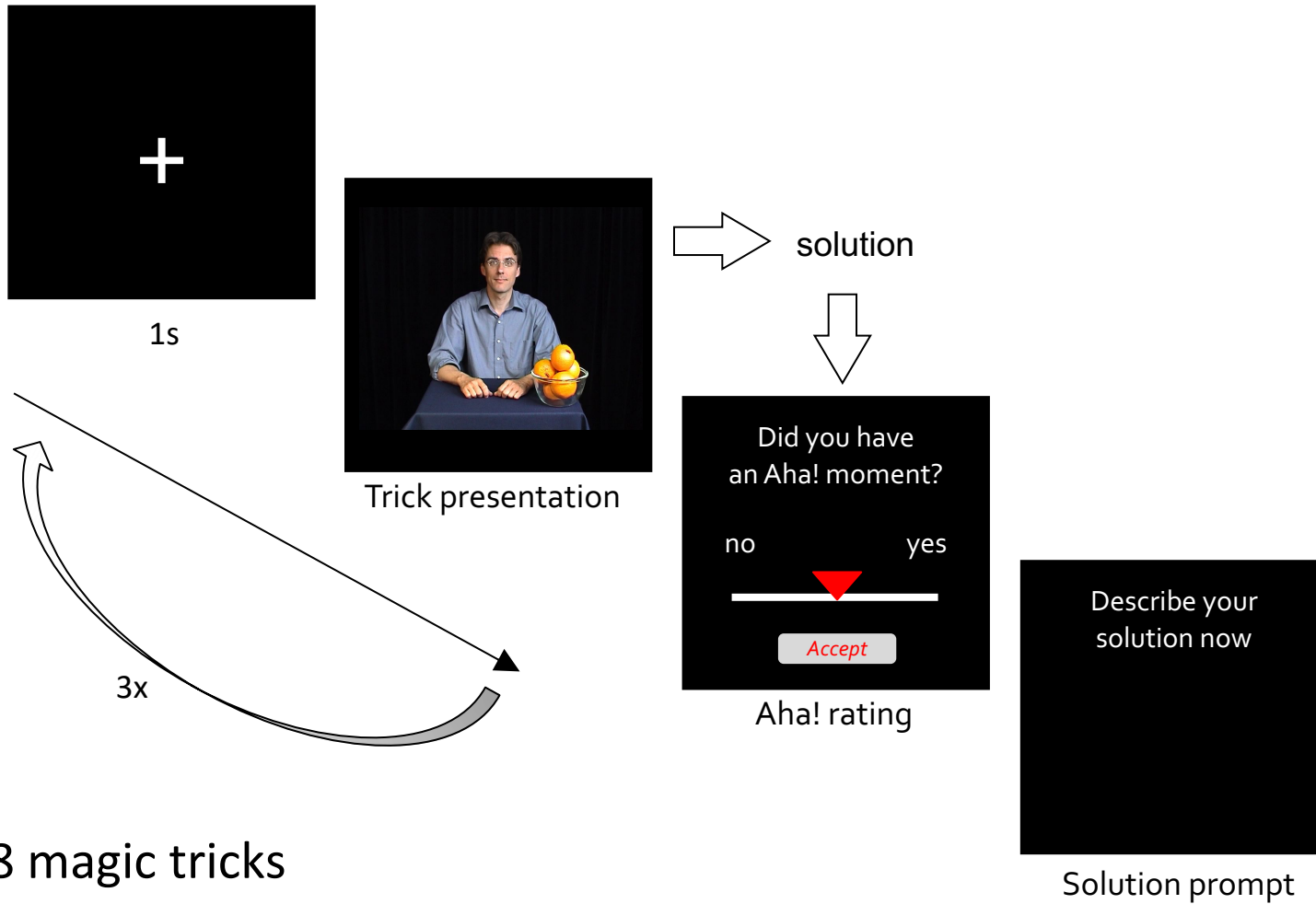


Matt Pritchard,
Physicist & Curator of Wonder



David Parr,
Magician & Author

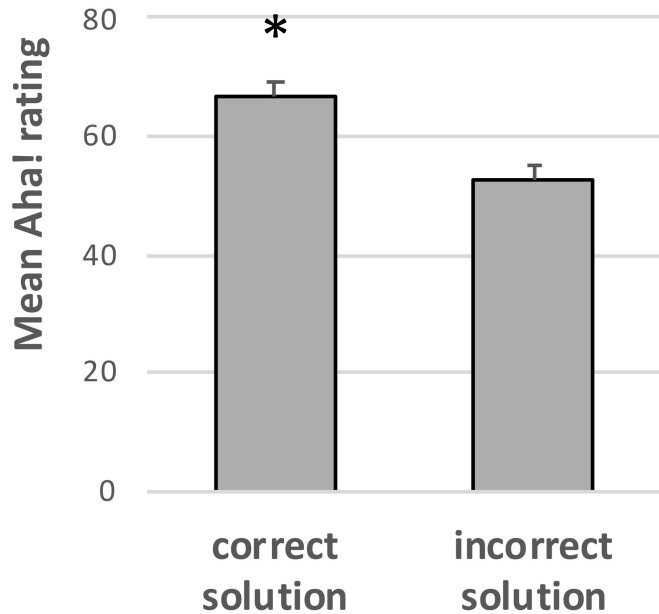
Typical experimental procedure



- 18 magic tricks
- Aha! rating
- No feedback on solution correctness

Accuracy effect of insight

Intuitive sense of success



$t_{(69)} = 10.21, p < .01, d = .76$. Error bars denote SEM.

(Figure from Danek & Wiley, 2017)

Feelings of Aha! signal correctness

(Danek et al., 2014; Danek & Wiley 2017; 2020; Salvi et al., 2016; Stuyck et al., 2022)

Aha = emotional marker for novel, surprising ideas

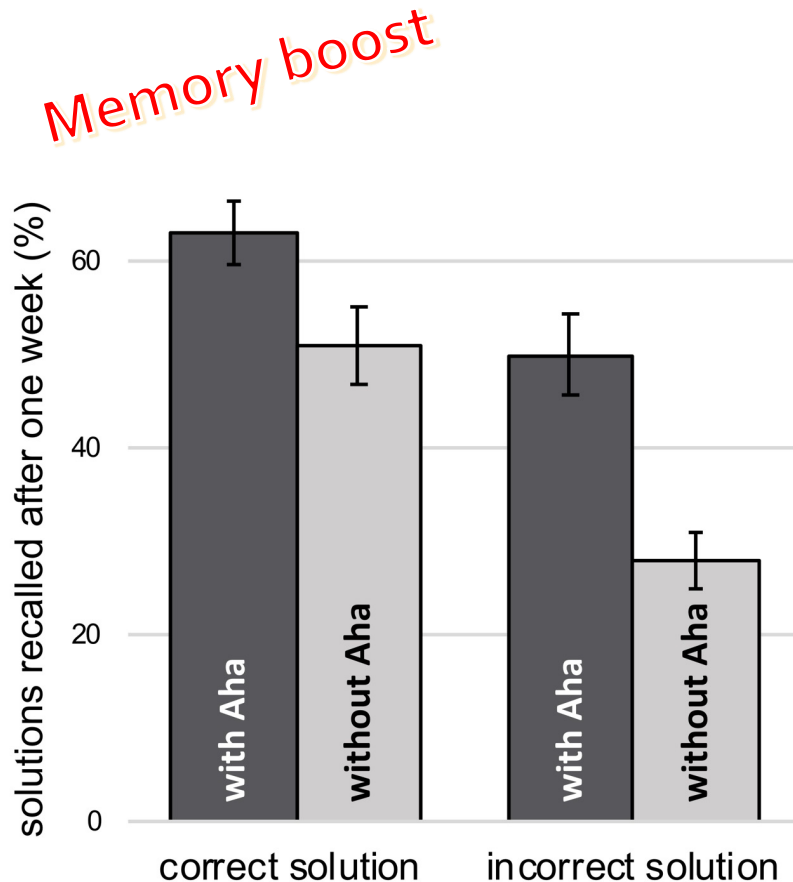
Applied to creative processes:

- Idea evaluation and selection (brainstorming)
- Functional analysis of technical systems

(Zimmerer et al., 2021)



Insight memory advantage



Feelings of Aha! enhance memory
(Danek et al., 2013; Kizilirmak et al., 2016;
Danek & Wiley, 2020)

Applied to

- Marketing (Shen et al., 2021)
- Educational settings (e.g. schools)


Figure re-plotted from:
Danek & Wiley (2020). What causes the insight
memory advantage? *Cognition*, 205, 104411.

Further reading...

nature reviews psychology

<https://doi.org/10.1038/s44159-023-00257-x>

Review article

 Check for updates

Restructuring processes and Aha! experiences in insight problem solving

Jennifer Wiley¹ & Amory H. Danek²

JOURNAL OF
Creative Behavior

Publication of the Creative Education Foundation



AMORY H. DANEK
CAROLA SALVI

Moment of Truth: Why Aha! Experiences are Correct

THINKING & REASONING, 2016

<http://dx.doi.org/10.1080/13546783.2016.1141798>

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Insight solutions are correct more often than analytic solutions

Carola Salvi^{a,b}, Emanuela Bricolo^c, John Kounios^d, Edward Bowden^e and Mark Beeman^a

Escaping fixation

Goal: To reduce the activation of initial, incorrect responses

→ to forget the fixation (Smith, 1995)



Achieved by time away from the task: Bed, bath and bus (Ovington, 2018)

- Switching between tasks

(George & Wiley, 2019; Lu et al., 2017; Smith et al., 2017)

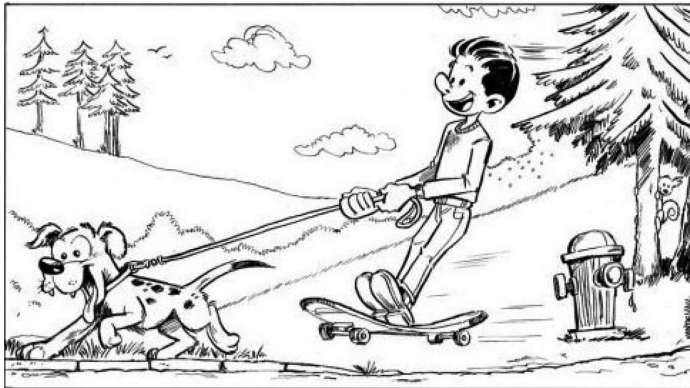
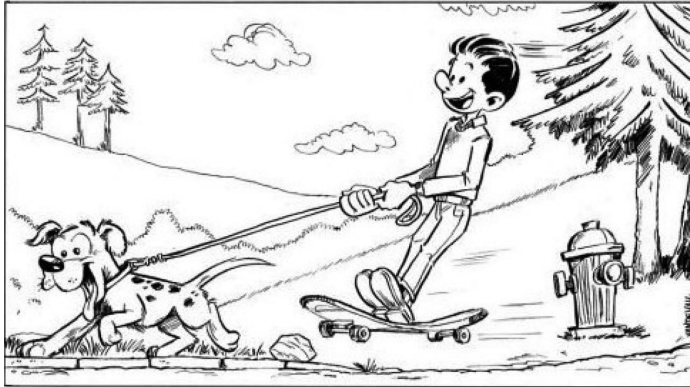
- Incubation: Breaks are beneficial (Sio & Ormerod, 2009)

→ Does it matter what we do during the break? → Yes!

(Caravona & Macchi, 2023)

Possible incubation activities

Find the differences task



Author: Tim van de Vall
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One-digit math problems

$$2 + 7 = \underline{\quad}$$

$$8 - 3 = \underline{\quad}$$

Three-digit math problems

$$382 + 220 = \underline{\quad}$$

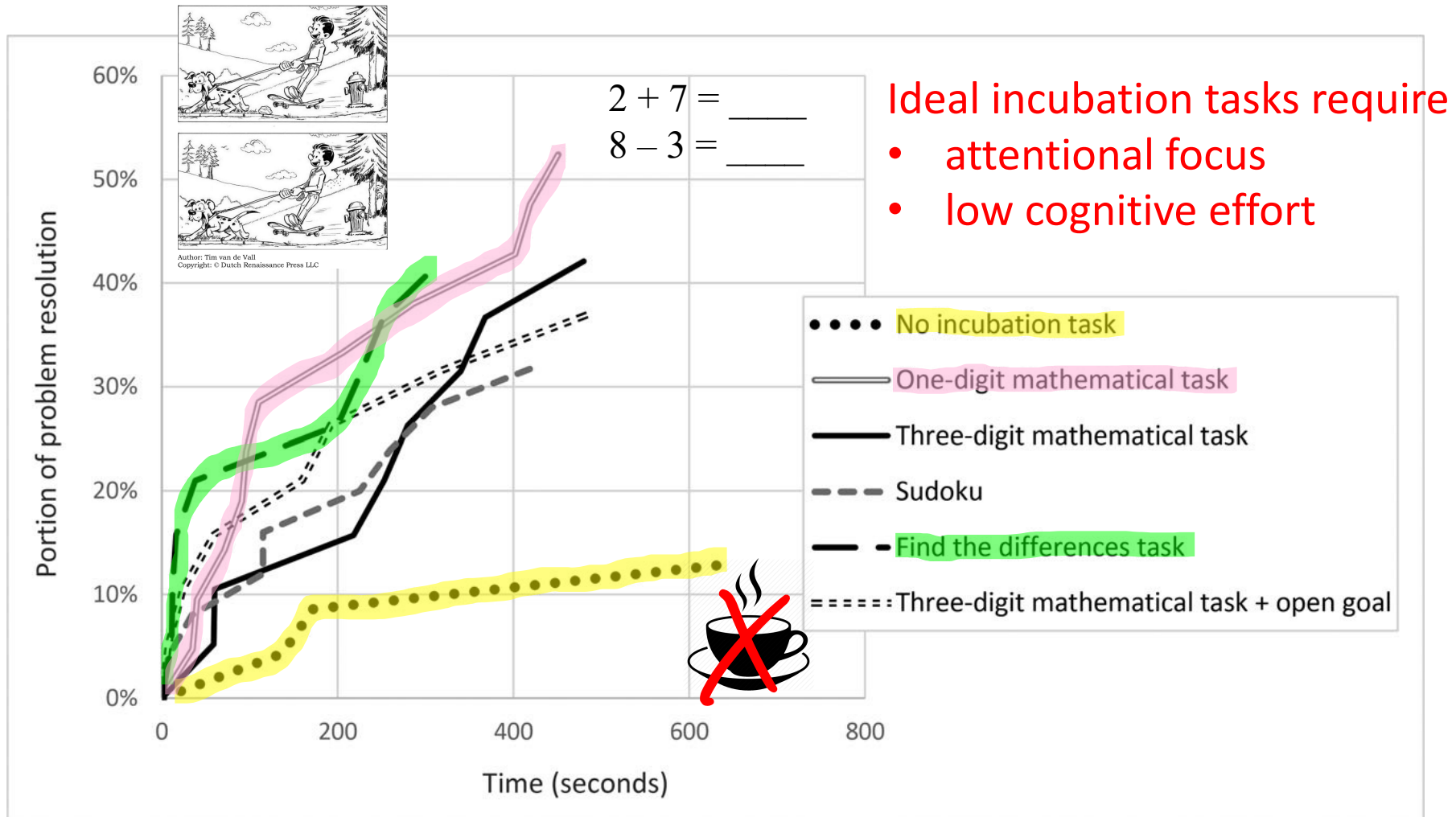
$$405 + 125 = \underline{\quad}$$

Sudoku

		6	8	4				
2		1		6				7
	3	9						1
				9	8	3		
	6							9
		7	3	2				
	4					1	3	
7				1		8		4
				3	5	7		



A coffee break is not enough



(figure from Caravona & Macchi, 2023)

Escaping fixation through incubation

- Low-demanding tasks (regardless of their nature) are most effective
 - require attentional focus → turn attention away from the problem
 - but leave resources available for unconscious restructuring processes

(Unconscious work theory, e.g., Gilhooly et al., 2013; Gilhooly et al., 2012)

- Coffee break: attention stays with the problem, still focused on problem
(no real incubation)

Training creative problem solving

- Hints are effective (e.g., Thomas & Lleras, 2009; Pétervári & Danek, 2020)

...but often problem-specific

...allow only near transfer (solving highly similar problems)

- Does far transfer exist at all? (meta-analysis by Sala & Gobet, 2017)
- Unspecific, domain-general training is needed
- One option: Training metacognitive strategies?

Theory of Inventive Problem Solving (TIPS)

- based on analysis of 40,000 patents
- key principle: Finding and overcoming **contradictions** yields creative new solutions
- provides a toolbox for creative problem solving
- training selected metacognitive strategies:
 - concept of *Operational Zone*: Which area is relevant for the problem and the solution?
 - method of *Smart Little People*: Problem is decomposed into its parts



Genrich Altshuller
(1926-1998)



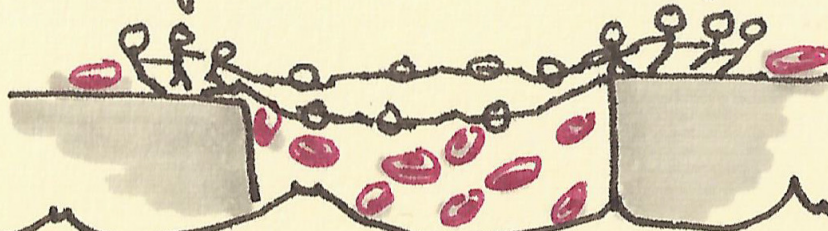
PROBLEM SOLVING

SMART LITTLE PEOPLE

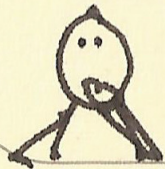
HOW WOULD THEY STOP A LEAK?

FORM A LINE!

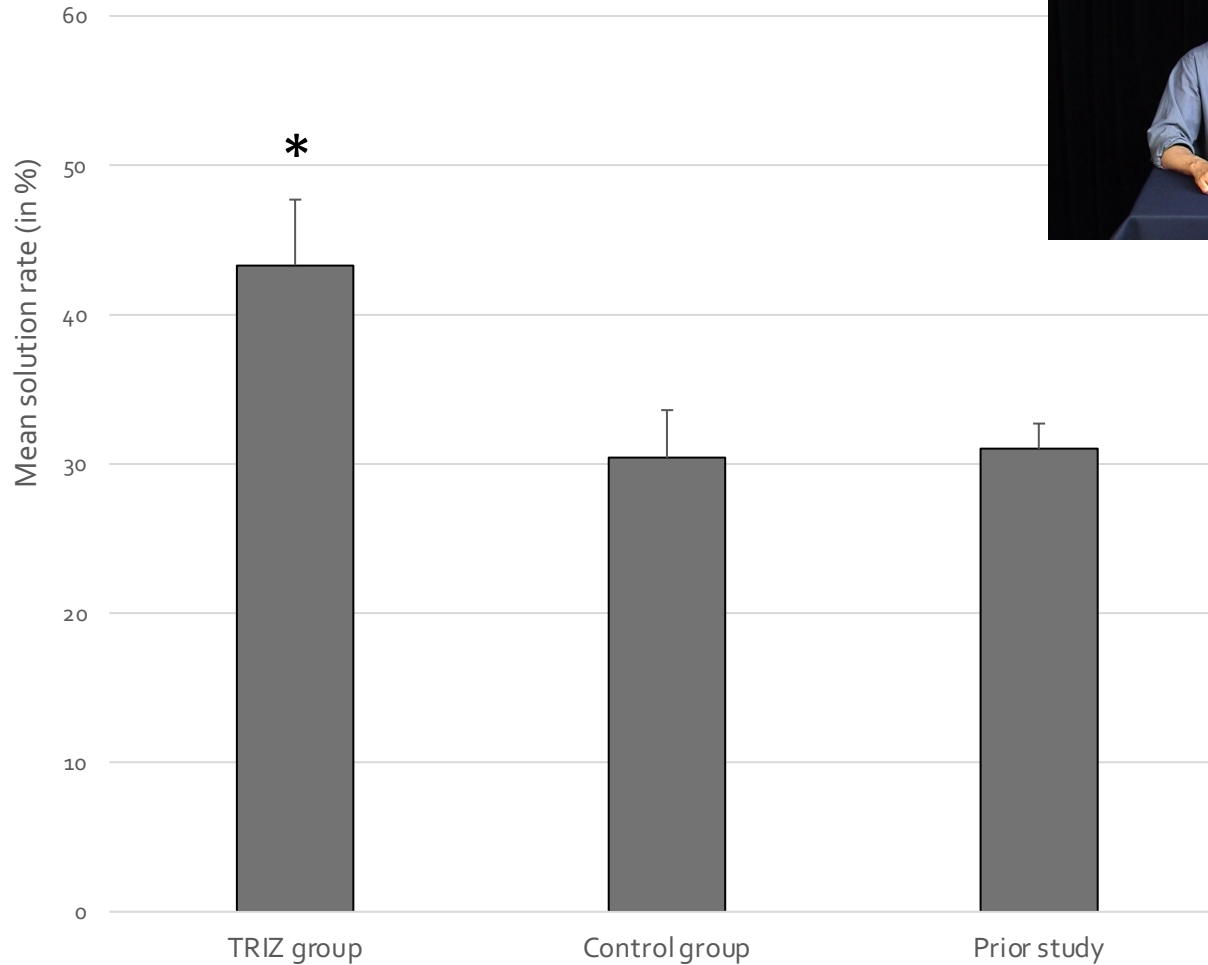
HOLD ON TIGHT!



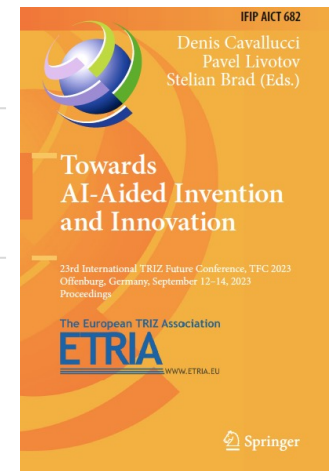
IF YOUR SYSTEM WAS MADE OF SMART LITTLE PEOPLE, HOW WOULD THEY SOLVE THE PROBLEM?



TIPS training is effective



$t(39) = 2.43, p = 0.02, \text{Cohen's } d = .17$ (figure from Laue & Danek, 2023)



Synopsis

- Cognitive and affective component of insight
- Joy of discovery
- Magic trick paradigm
- Benefits of insight: Feelings of Aha! signal correctness and boost memory
- Effective ways to overcome fixation: Task switching, incubation
- Insight can possibly be trained (metacognitive strategies)

Want to know more?

NOVEL APPROACHES FOR STUDYING CREATIVITY IN CREATIVE COGNITION, ARTISTIC PERFORMANCE AND ARTISTIC PRODUCTION

EDITED BY: Philip Fine, Amory H. Danek, Kathryn Friedlander, Ian Hocking
and William Forde Thompson

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Link to Research Topic

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SPECIAL ISSUE
Studying the Cognitive and Affective Aspects of Insight
Problem Solving

GUEST EDITORS
Amory H. Danek and Jasmin M. Kizilirmak

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<https://doi.org/10.1080/20445911.2021.1967962>

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EDITORIAL

The whole is more than the sum of its parts – addressing insight problem solving concurrently from a cognitive and an affective perspective

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ABSTRACT

The last 15 years have witnessed a surge of new studies and increased efforts to better understand the elusive phenomenon of insight. This special issue reflects the expanding field of research on insight problem solving. To counter unresolved definitional and methodological challenges, a series of papers was collected that allows for a high degree of comparability by using similar methods of measurement, including either an assessment of the subjective Aha! experience or restructuring or both. As a result, some converging findings across studies and paradigms could be identified. We believe that future work should continue on this path, moving towards a consensus of how insight should be measured.

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KEYWORDS

Insight; problem solving; restructuring; Aha



Link to Special Issue

Thank you for your interest!



www.amorydanek.de

And many thanks to...

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Bial 30^{years}
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