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A Methodological Study of the Use of “Aha!” Ratings in Research on Insight Problem Solving and Creativity

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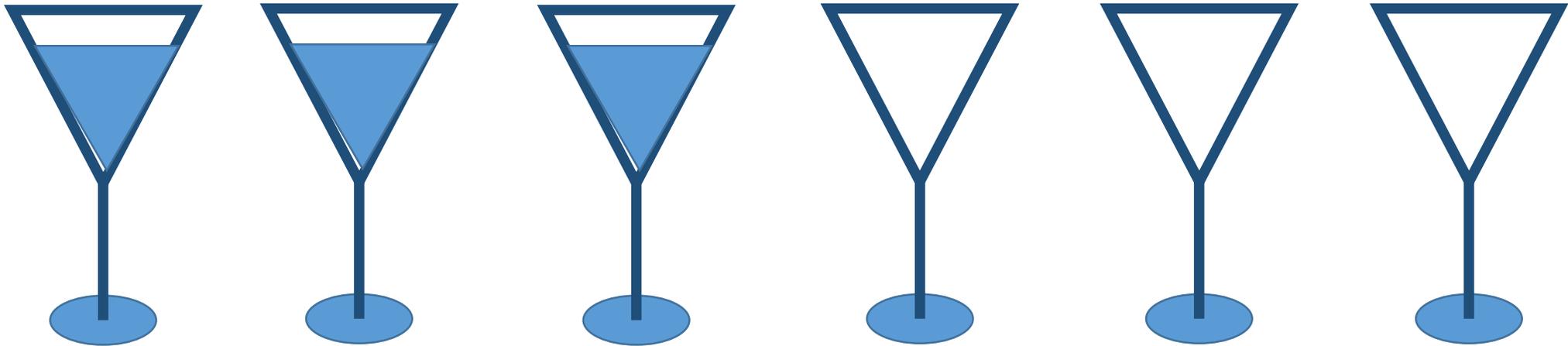
Insight Problem Solving, Impasse, and Working Memory Capacity

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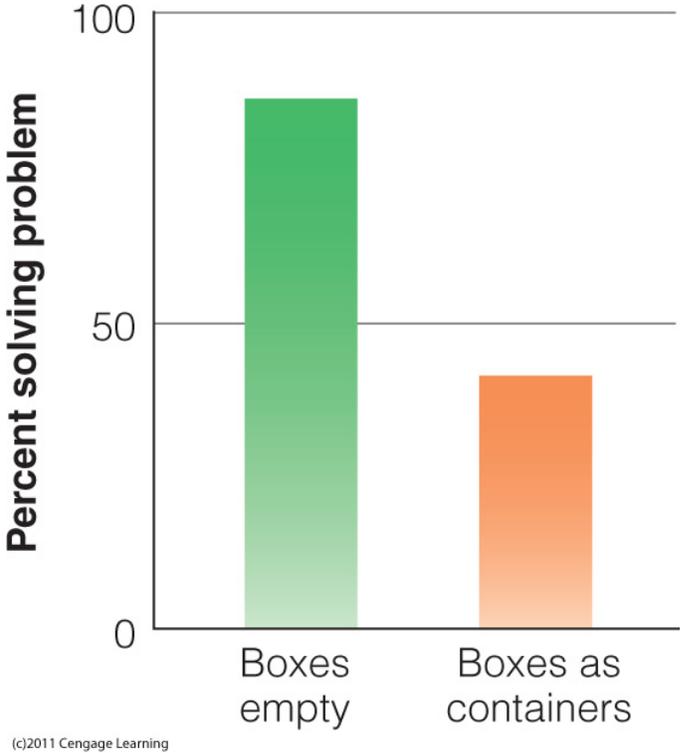
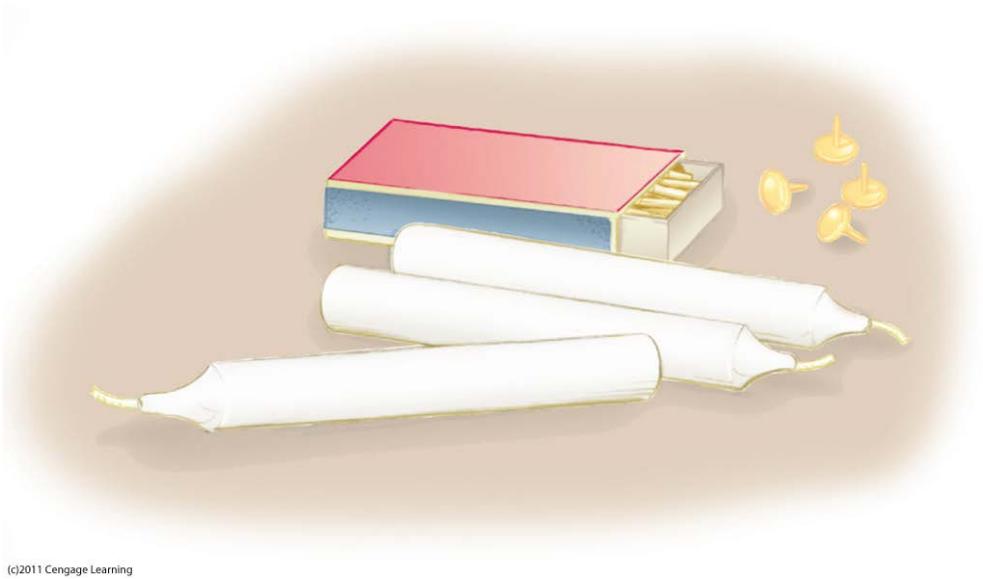
Make it so no two glasses containing liquid are next to each other. To do this, you can only move ONE glass



Insight vs. Incremental Problem Solving

- Incremental Problem Solving
 - Apply strategies and prior knowledge to solving a new problem
 - Work your way systematically from the initial state to the goal state
 - Involved planning multiple step, trial and error, exploring the problem space
 - Difficulty is determined by number of steps or size of the problem space
- Insight Problem Solving
 - The solving strategies and prior knowledge activated by the initial problem state are inappropriate for finding a solution
 - If you continue using these strategies you will get stuck or reach impasse
 - People will sometimes overcome this impasse and suddenly discover the correct solution (“Aha! moments”).

Gestalt Psychology and Restructuring



Dunker (1945)

How do people get “unstuck” in problem solving?

Gestalt View

Insight requires three key components: an inaccurate initial problem representation, impasse, and restructuring

Restructuring is an automatic, unconscious process triggered by impasse

- Spreading activation in semantic memory (Ohlsson, 1992; 2011)
- Switch between fine and course grain processing (Jung-Beeman et al., 2004)
- Chunk decomposition (Knoblich et al., 1999)
- Constraint relaxation (Knoblich et al., 1999)

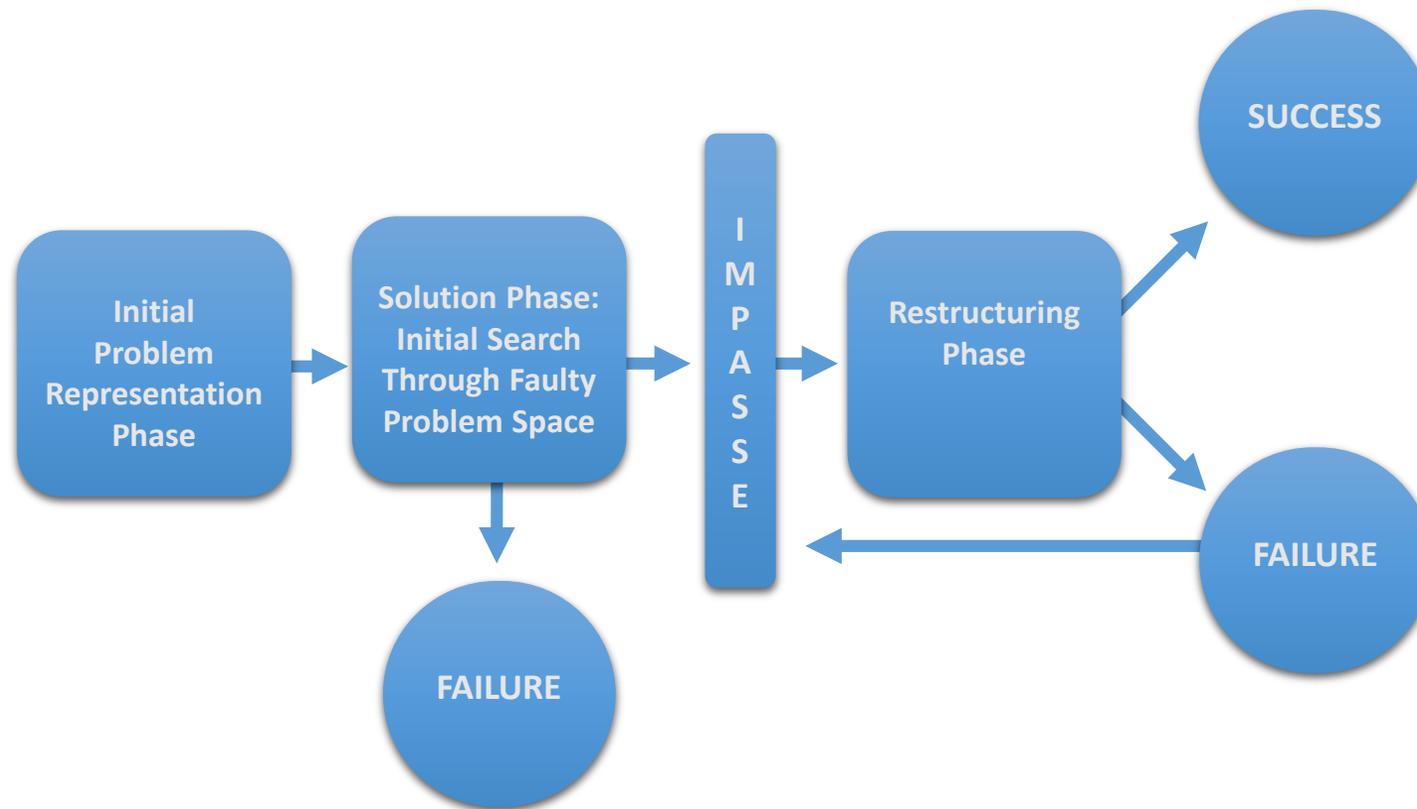
Business as Usual View

Insight problem solving is no different from non-insightful problem solving (Chein & Weisberg, 2013; Ball & Stevens, 2009; Chronicle et al., 2004)

Restructuring is not a unique phase of insight problem solving and is not automatic or unconscious

All steps are effortful and controlled just like in incremental problem solving

Information Processing Framework of the Insight Problem Solving

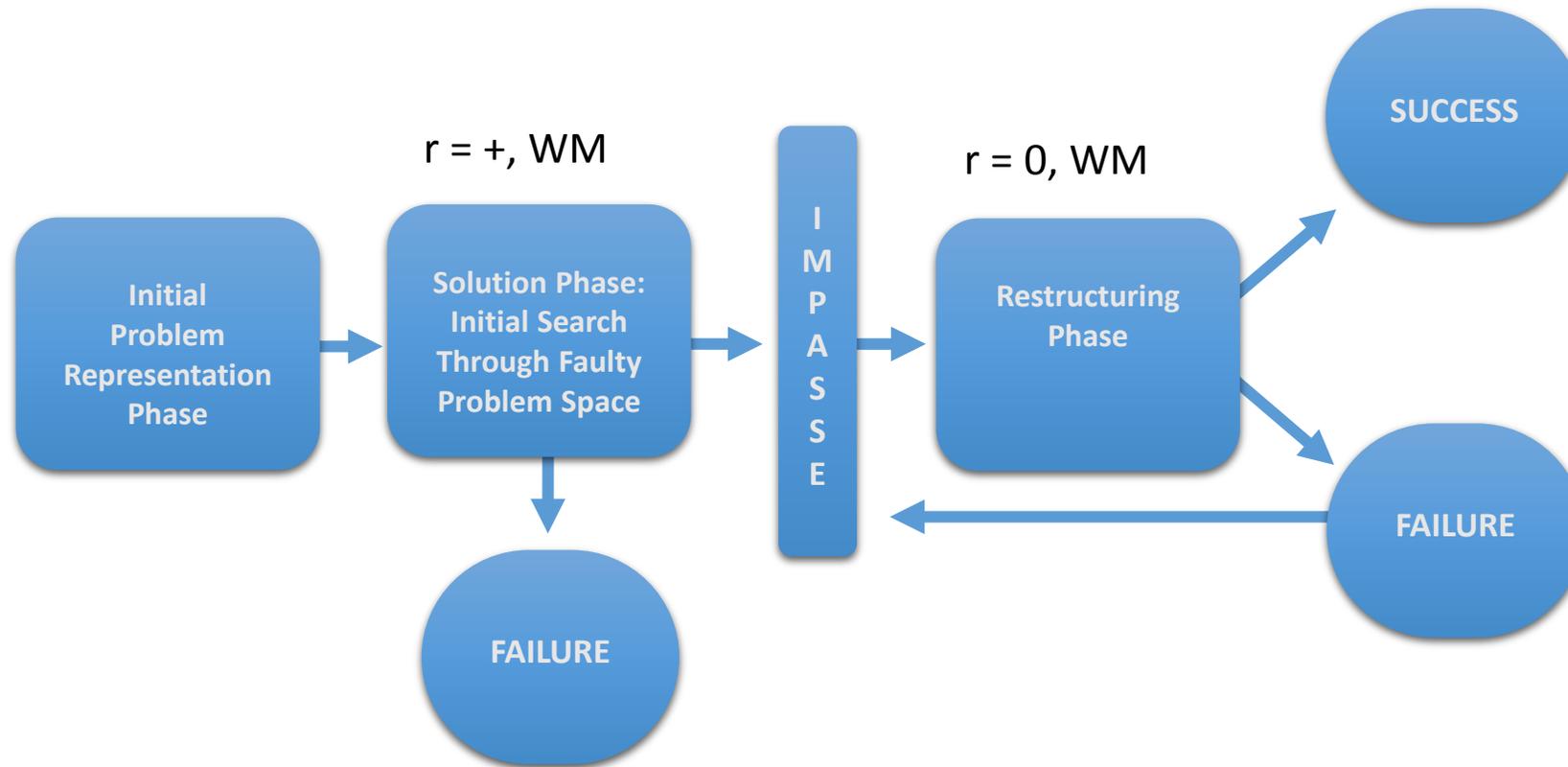


Ash & Wiley (2006)

Working Memory Capacity and Controlled Processing

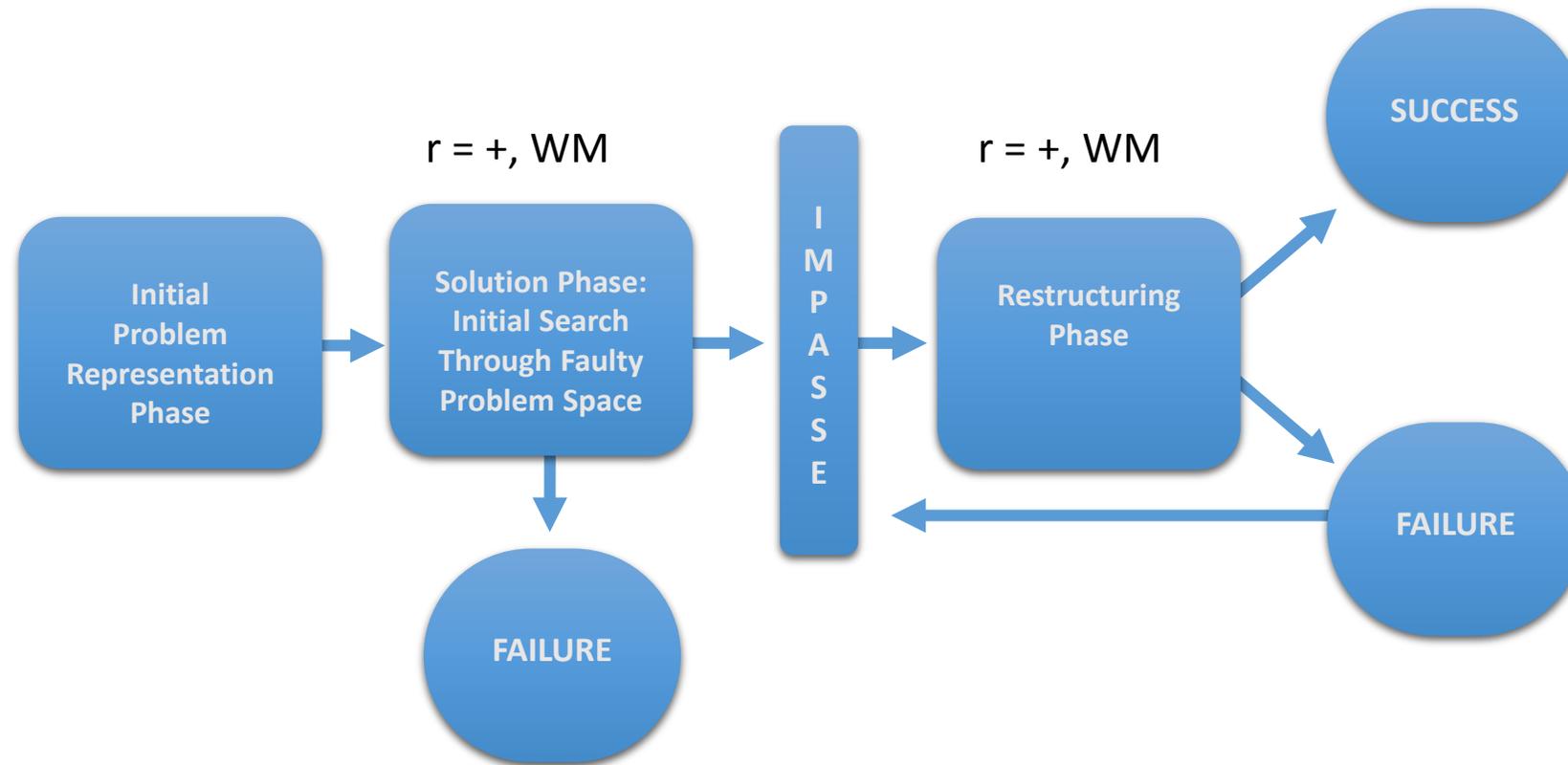
- Working Memory Span Tasks – require people to hold information in short term memory while doing a concurrent processing task.
 - Operation Span: IS $(9 \div 3) + 2 = 2$? AUNT
 - Reading Span: All parents hope their list will grow up to be intelligent. ? R
- Shown to be highly correlated with a wide range of attention demanding controlled processing tasks (see Conway & Kane, 2001).
- Individual differences in WM span represents individual differences in people's Central Executive abilities to control attention.
- Therefore, success at strategic and attention demanding problem solving processes should be correlated with WM capacity.

Automatic Restructuring Theories



Ash & Wiley (2006)

“Business as Usual” Theories

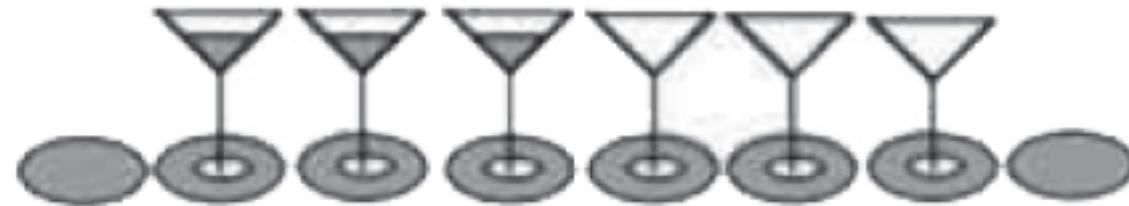


Ash & Wiley (2006)

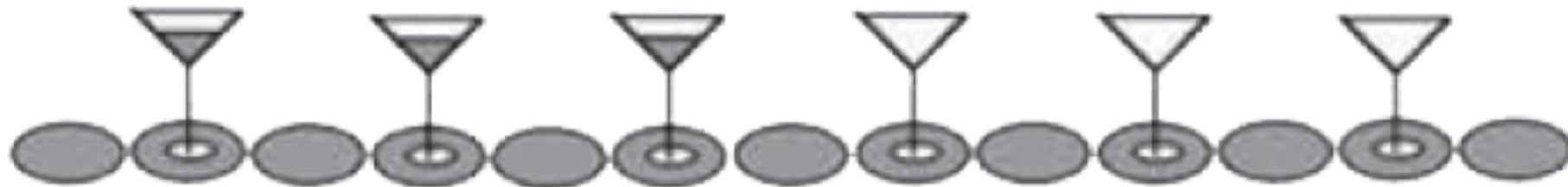
Working Memory & Insight Problem Solving

Ash & Wiley (2006)

Few Moves

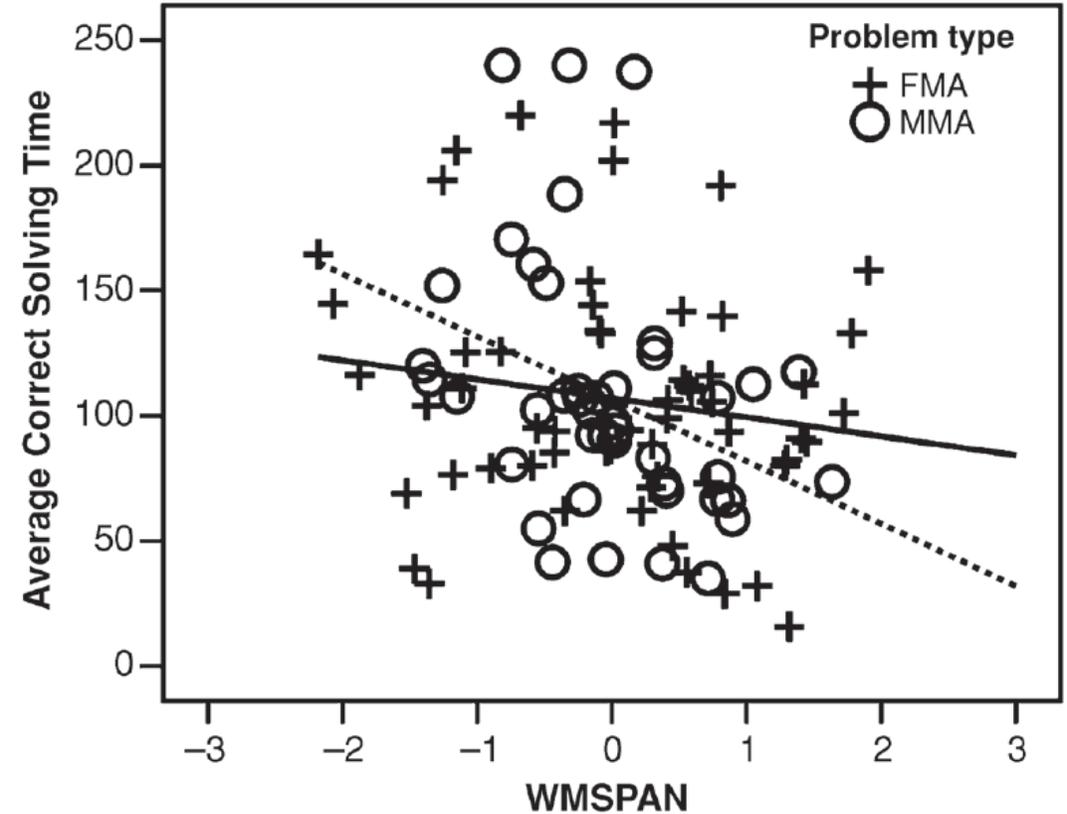
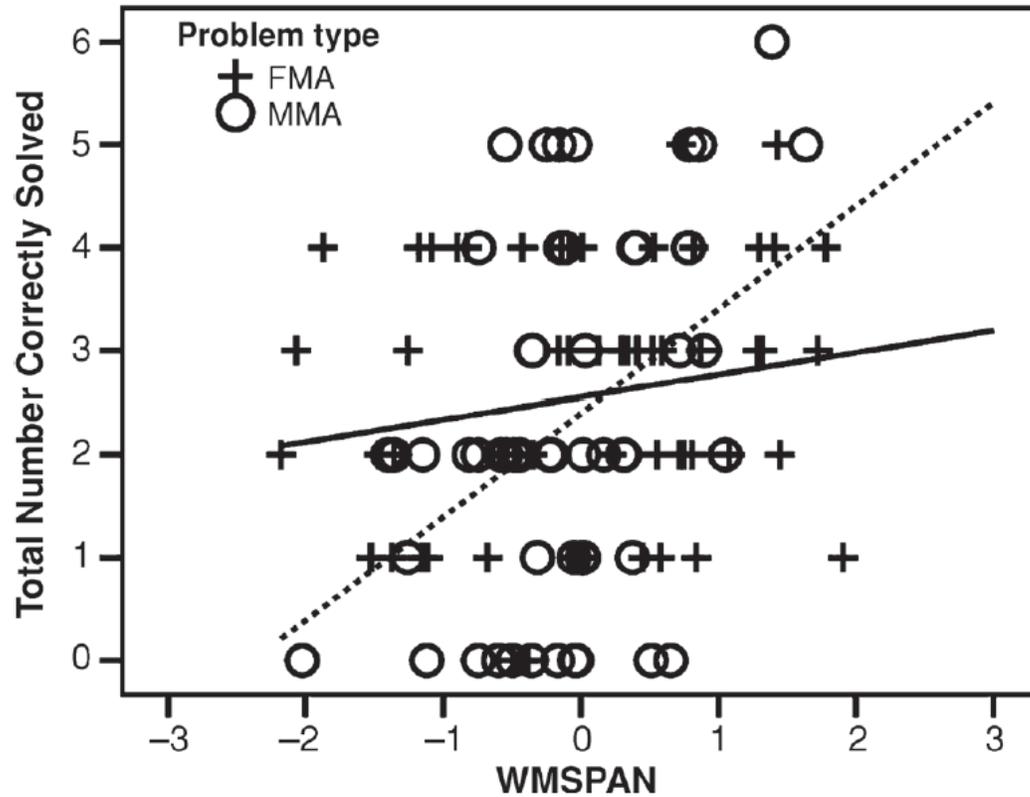


Many Moves



Working Memory & Insight Problem Solving

Ash & Wiley (2006)



Working Memory & Insight Problem Solving

Chein & Weisberg (2014)

- Remote Associates Task
 - Provide a word that forms a common two word phrase or compound word with the following cue words.
 - age mile sand
- Had people rate whether their solution involved an “Aha!” experience or was achieved incrementally.
- Measure participants WM span.
- Verbal WM & Problems Solved with “Insight” $r(50) = .39$
- Verbal WM & Problems Solved without “Insight” $r(50) = .10$

Current Study

- Attempted to replicate results of Chein & Weisberg (2013)
- However, instead of using subjective ratings of “Aha!” experiences, we operationally defined “insight” as reaching solution after impasse.
- If the Business As Usual Theory is correct then solutions reached with and without impasse should both be correlated with WM span.
- If the Automatic Process theories are correct then solutions reach after impasse should not be correlated with WM span.

Method

- Participants: 70 undergraduates from the Psychology Department subject pool participated in this research for partial completion of a course requirement or extra credit.
- Working Memory Span: Participants completed automated Operation Span and Reading Span tasks. These scores were combined to make a working memory composite score (Cronbach's $\alpha =$
- Remote Associates Task: Participants completed 60 remote associates problems. They were asked to "Think aloud" while solving the problems. Participants were video recorded while solving the problems.
- Impasse Coding: Videos were coded for Impasse by independent coders (coding ongoing). Currently 53 participants have complete data.

Impasse Coding

Used Knoblich et al.'s (1999) operational definition of impasse: “the cessation of overt problem-solving behavior” which is “accompanied by a subjective feeling of not knowing what to do”

- Periods of silence even after reminders; verbal indications of impasse (e.g., “I don’t know what to do”, “I’m lost”), physical stillness where they stop writing on the paper, frustrated language or body language, and mindless repetition of the instructions

Results

- 16 participants were dropped for either not being native English speakers and/or failing to maintain 85% accuracy on the processing component of the WM span tasks.
- 18 verbal protocols have yet to be coded for impasse
- All analyses were completed on 43 subjects with complete data at this point.
- Preliminary results.

Solution Success

| | Chien & Weisburg (2014) | | Current Study | |
|----------------------------|-------------------------|--------|---------------|--------|
| | M | SD | M | SD |
| Total Solved (60) | 42% | 13% | 37% | 11% |
| Solved via Insight | 63% | 28% | 17% | 13% |
| Solved without Insight | 36% | 23% | 83% | 27% |
| Insightful Solving Time | 10.14 s | 6.06 s | 11.25 s | 5.13 s |
| Noninsightful Solving Time | 21.74 s | 6.16 s | 13.22 s | 3.68 s |

Solution Success Insight vs. Non-insight: $t(42) = -13.87, p < .001$, Cohen's $d = -2.12$

Solution Time Insight vs. Non-insight: $t(36) = -2.57, p = .015$, Cohen's $d = -0.42$

Correlations with WM

| | Chein & Weisberg (2014) | Current Study | | |
|-----------------------------|-------------------------|----------------|--------------|--------------|
| | Operation Span | Operation Span | Reading Span | WM composite |
| Total Solved | $r = .43^*$ | $r = -.02$ | $r = .11$ | $r = .06$ |
| Solved with Insight | $r = .39^*$ | $r = .17$ | $r = .18$ | $r = .17$ |
| Solved without Insight | $r = .01$ | $r = -.02$ | $r = .03$ | $r = -.02$ |
| Insightful Solving Time | na | $r = -.12$ | $r = -.38^*$ | $r = -.30^*$ |
| Non-insightful Solving Time | na | $r = -.31^*$ | $r = -.38^*$ | $r = -.40^*$ |

* $p < .05$, one-tailed

Conclusions

- These results show that how researchers operationally define “insight” can lead to different empirical results.
- The “Aha!” rating operational definition of insight used by Chein & Weisberg (2014) found evidence supporting the “Business as Usual” view of restructuring.
- The solution after impasse definition of insight used in the current study lead to no support for the “Business as Usual” view, and revealed solving time correlations consistent with Automatic Process views.
- These results suggest that part of the debate between “Business as Usual” and Automatic Process theories maybe due to methodological differences in how researcher define “insight” and attempt to study restructuring.