



**6th IRCRA Congress
Bern 2023**

Memory in Bouldering

Dr. Jerry Medernach

Henz Julian

Prof. Dr. Daniel Memmert



**LËTZEBUERG
LIEFT SPORT**

**6th IRCRA Congress
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Q & A



Introduction



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Discussion



Results

Memory in Bouldering

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Are bouldering skills related to memorising and recalling climbing holds and moves?

John Locke (1690)



Seven Phenomenon

- **Almost 100% recall accuracy for up to seven objects**
- **Considerable decrease in more than seven objects**

George Miller (1956)



The Magical Number Seven

VOL. 63, No. 2

MARCH, 1956

THE PSYCHOLOGICAL REVIEW

THE MAGICAL NUMBER SEVEN, PLUS OR MINUS TWO:
SOME LIMITS ON OUR CAPACITY FOR
PROCESSING INFORMATION¹

GEORGE A. MILLER

Harvard University

Nelson Cowan (2001)

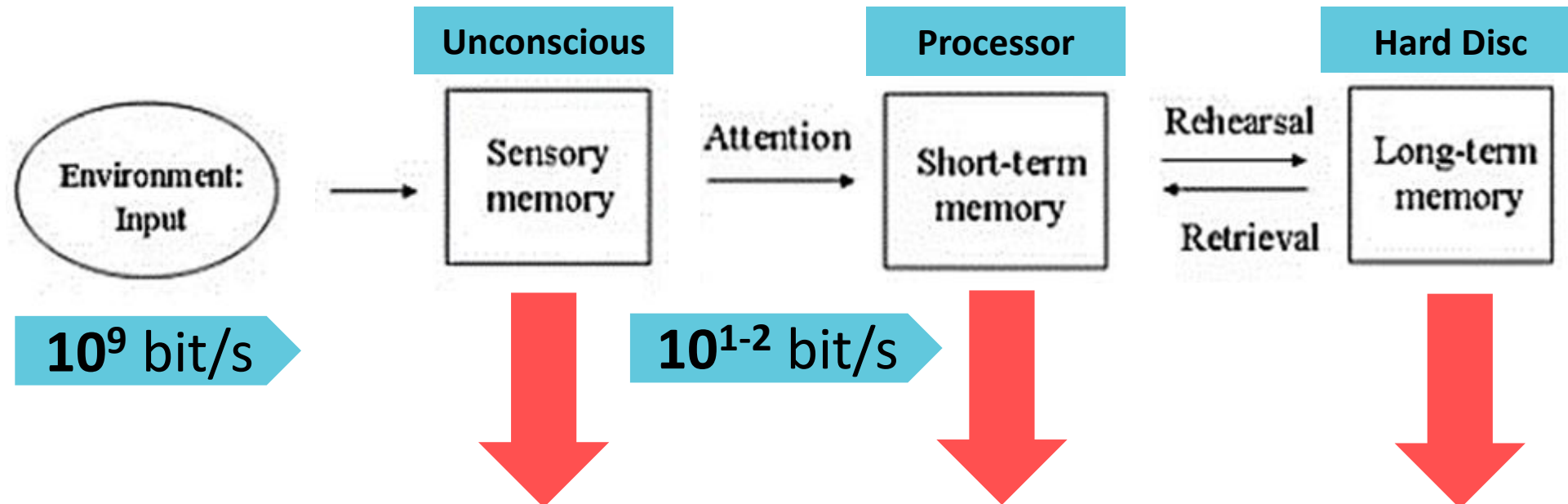


Dr. Jerry Medernach

Magical Number Four

- **If items must be perceived as separate objects within a short period, the typical limit is on the order of three or four**

Atkinson & Shiffrin (1968)



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Participants

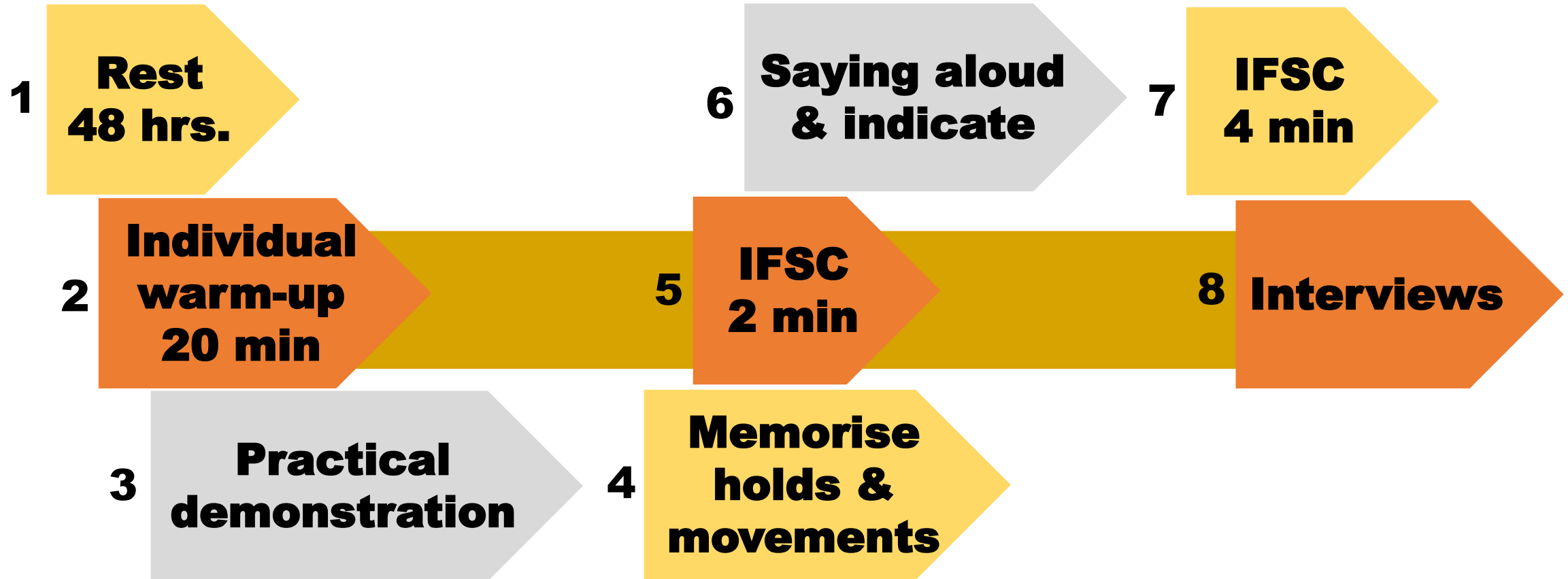
60 male bouldering athletes
18 years old; healthy; no recent injuries

Intermediate
 $n = 20$
IRCRA: 16 ± 1
yrs.: 1.5 ± 1
Comps: 3.4 ± 3

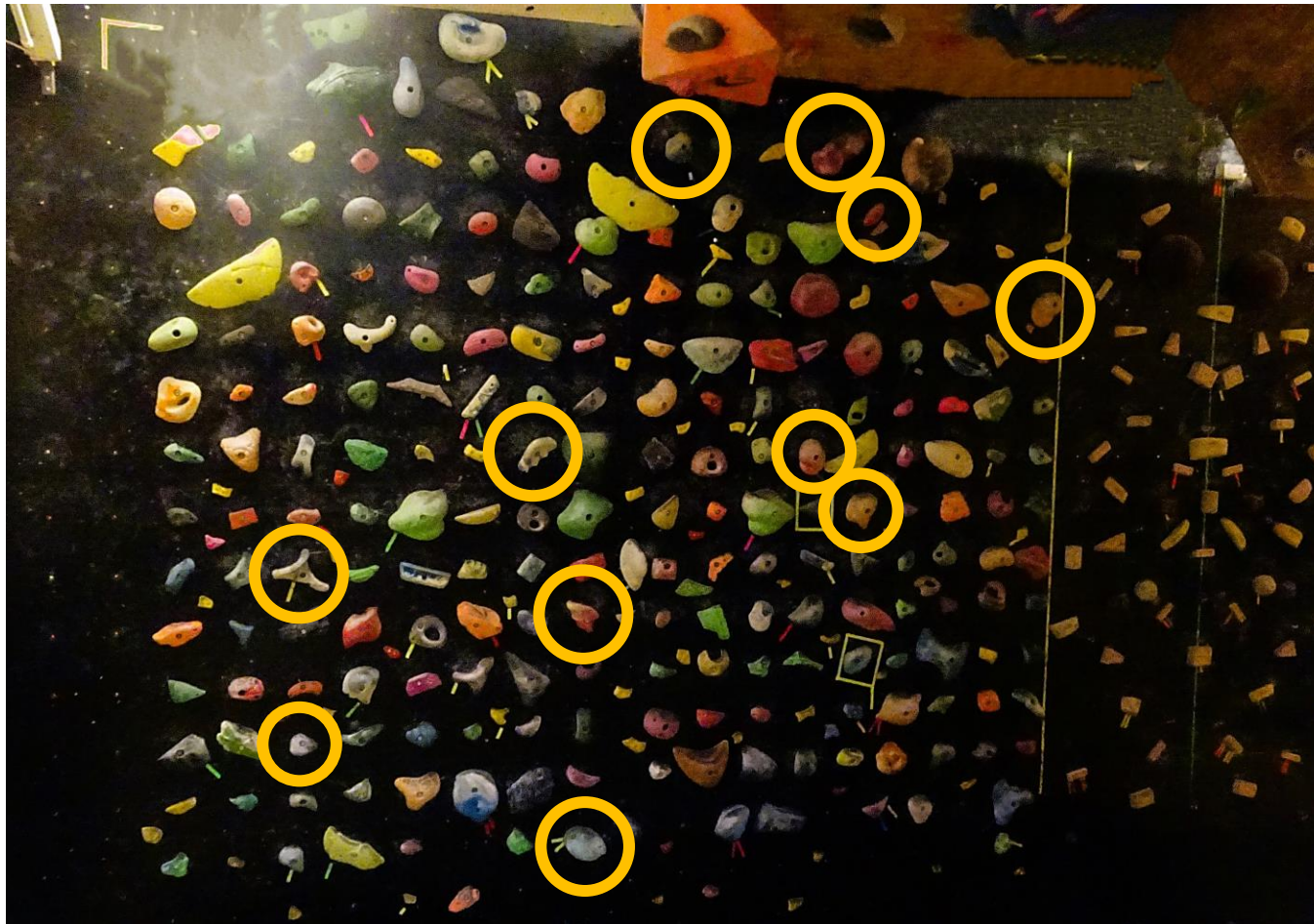
Advanced
 $n = 20$
IRCRA: 22 ± 2
yrs.: 6.8 ± 5
Comps: 11.4 ± 7

Elite
 $n = 20$
IRCRA: 26 ± 1
yrs.: 10.3 ± 5
Comps: 33.8 ± 20

Methods



Spray Wall



- **3 m high & 30°**
- **Various holds**
- **Holds: 10**
- **Movements: 9**
- **Foot-to-hand**
- **IRCRA: 20 points**
→ **advanced level**

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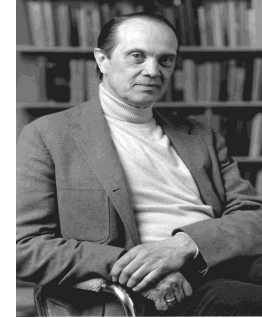


Results



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Results



	Intermediate	Advanced	Elite
Holds	$3.9 \pm 1^*$	6.4 ± 1^{ns}	$7.1 \pm 2^*$
Movements	$3.5 \pm 1.1^*$	$6.1 \pm 0.8^*$	$7.9 \pm 0.3^*$
Tops	2^*	20^{ns}	20^*
Repetitions	$3.0 \pm 1^*$	1.5 ± 0.7^{ns}	$0.9 \pm 0.4^*$
Rehearsal	$107 \pm 15^*$	$85 \pm 26^*$	$44 \pm 15^*$

Bouldering expertise is positively associated with the ability to memorise and recall domain-specific information

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Post-Experimental Interviews

	Intermediate	Advanced	Elite
Focus on holds	75%*	20% ^{ns}	10%*
Focus on movements	15% ^{ns}	10% ^{ns}	5% ^{ns}
Focus on both	10%*	70% ^{ns}	85%*

George Miller (1956)



Chunking Concept

Pi = 3.1 4 1 5 9 2 6

“May I Have A Large Container Of Coffee”

Boschker et al. (2002)

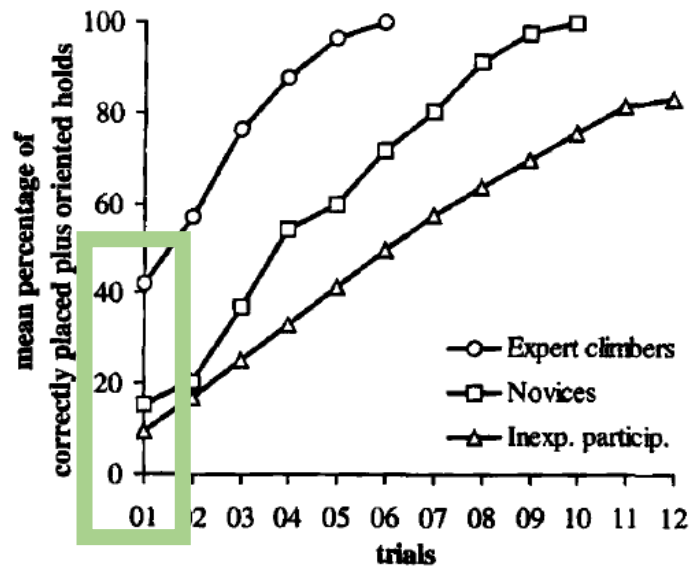


FIGURE 3. Performance on the reproduction task by the inexperienced participants (inexp. particip.), novices, and expert climbers. Reported are the mean percentage of correctly placed plus oriented holds on the scale model of the climbing wall per trial. Trial 1 was performed after participants had viewed the climbing wall for 2.5 min, Trials 2–12 were performed after they had viewed the wall for extra periods of 5 s.

- **Skill in sport climbing is associated with better memory**
- **Experts focus more on functional aspects (climbing opportunities)**
- **Memorise functional chains of holds (meaningful whole)**

The role of Expertise

- **Motor chunks increase memory** (Pezzulo et al., 2010)
- **Chunks are created based on climbing experience** (Pezzulo et al., 2010)
- **Large repertoire enables experts to compare sensory input with patterns stored in long-term memory** (Cowell et al., 2019; Roca & Williams, 2016)
- **Recognition of familiar patterns** (Sala & Gobet, 2017)
- **More successful clustering into meaningful unit**

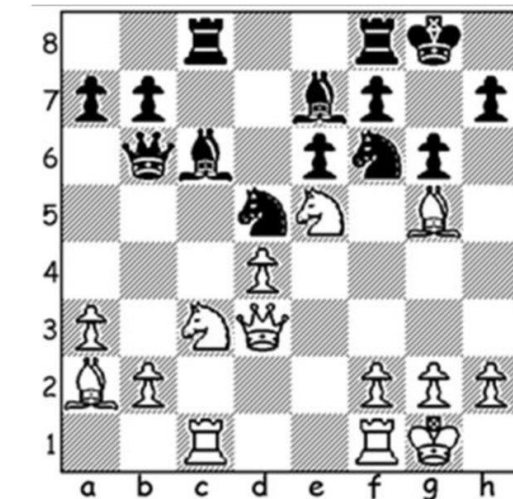
de Groot (1965) Thought and Choice in Chess

Experiment 1:

- **Grandmasters: ~ 93%**
- **Masters: ~ 72%**
- **Amateurs: ~ 50%**
- **Novice players: ~ 33%**

Experiment 2:

- **All players, from master to novice, recalled only about **three to four** pieces on the average**



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Practical Guidelines

- **Short-term memory:** limited in storage capacity and duration
- **Long-term memory:** repertoire of climbing movements



Information

**Deliberate
Practice**

Repetition

Variation

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Limitations

- **General statements on memory in indoor bouldering can only be made to a limited extent**
 - **Spray walls vs. conventional bouldering walls**
 - **Memorisation of sequence among many holds**
 - **Observational learning with practical demonstration**
 - **Sample size**
 - **Classification of climbing expertise**
 - **Limitation of self-reports**

Pezzulo et al. (2010)

- When Affordances Climb into your Mind:
Advantages of Motor Simulation in a Memory Task Performed by
Novice and Expert Rock Climbers
- Giovanni Pezzulo^{a,b}, Laura Barca^c, Alessandro Lamberti Bocconi^d, Anna M. Borghi^{b,e}
- **On the difficult route, elite climbers showed a more accurate recall than novice climbers**
 - **Experts' memory advantage disappeared when they were exposed to both an easy and an impossible route**
 - **When the difficulty exceeds climbers' motor skills, they are impeded from mentally visualising the movements, which negatively affects their recall performance**

Post-Experimental Interviews

	Intermediate	Advanced	Elite
Mental visualisation	15%*	90% ^{ns}	100%*

Positive effect between mental visualisation and:

- recalled holds: $b = 0.13$; $R^2 = .37$; $F(1, 59) = 21.84$; $p < .001$
- recalled climbing movements: $b = 0.17$; $R^2 = .53$; $F(1, 59) = 64.59$; $p < .001$