Between-item Similarity Frees Up Working Memory Resources Through Compression: A Domain-General Property

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Introduction

Encoding A B C D E F

Recall A ‘ D C X F

Item memory ⟷ Order memory

Introduction

Encoding A B C D E F

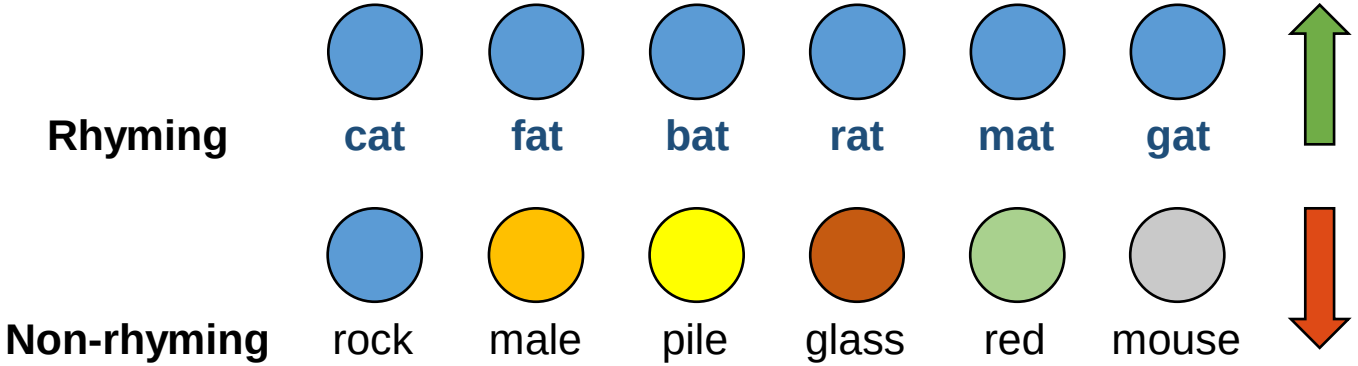
Recall A ‘ D C X F

Item memory ⟷ Order memory

Introduction

Between-item similarity enhances WM performance

Phonological similarity. Rhyming vs. non-rhyming words

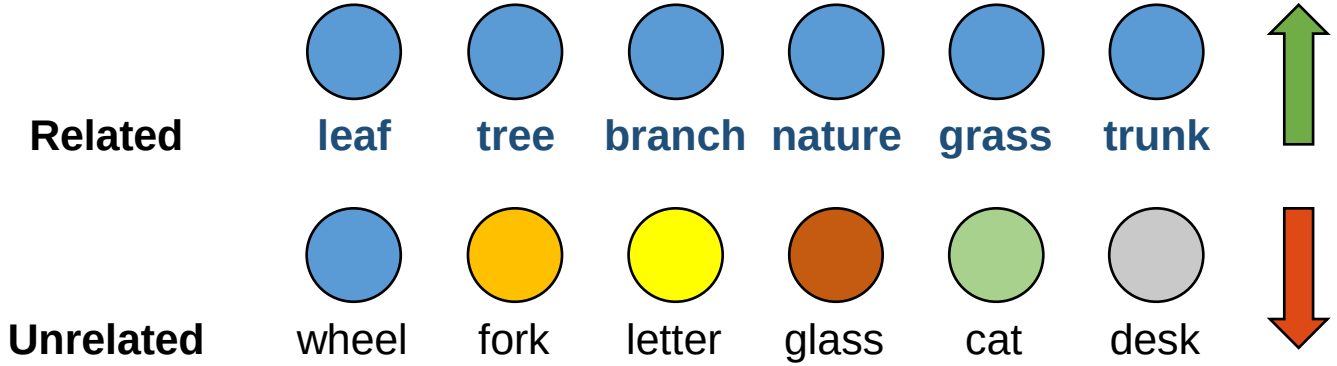


Gupta et al. (2005)

Introduction

Between-item similarity enhances WM performance

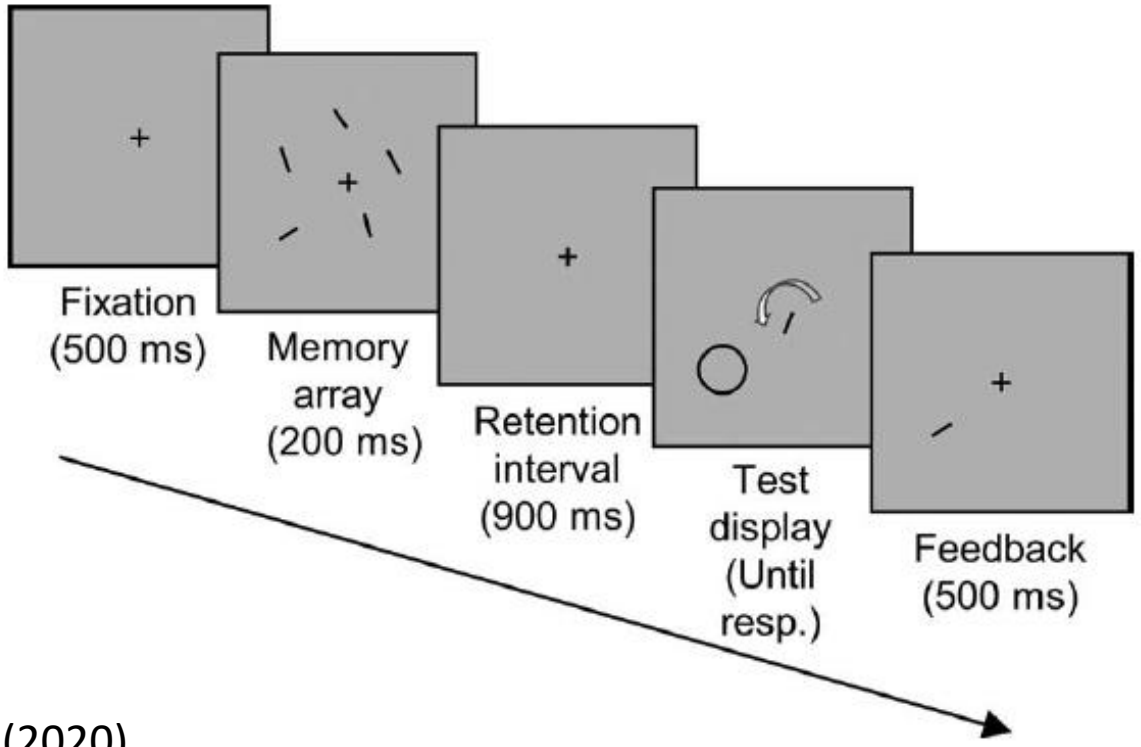
Semantic relatedness. Semantically related vs. unrelated words



Poirier & Saint-Aubin (1996)

Introduction

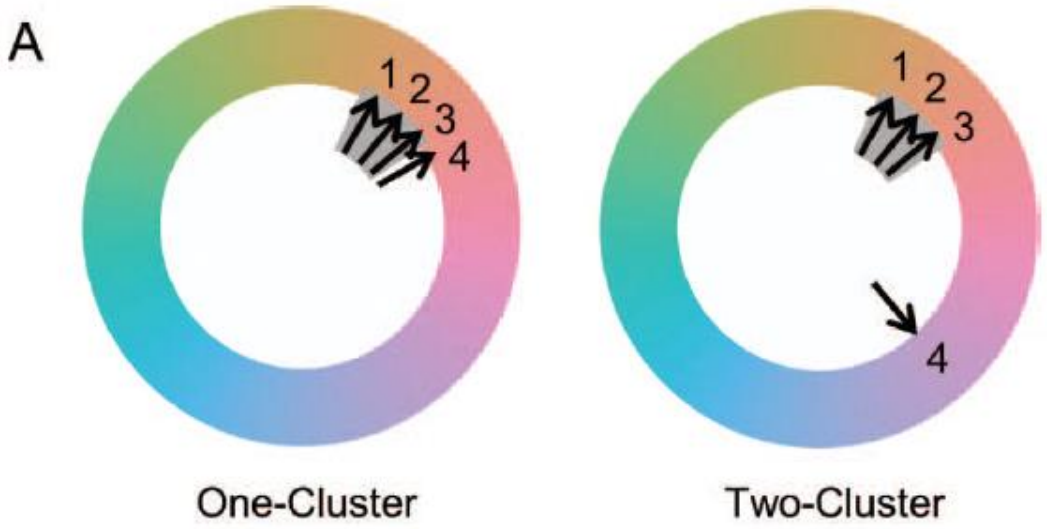
Between-item similarity enhances WM performance



Son et al. (2020)

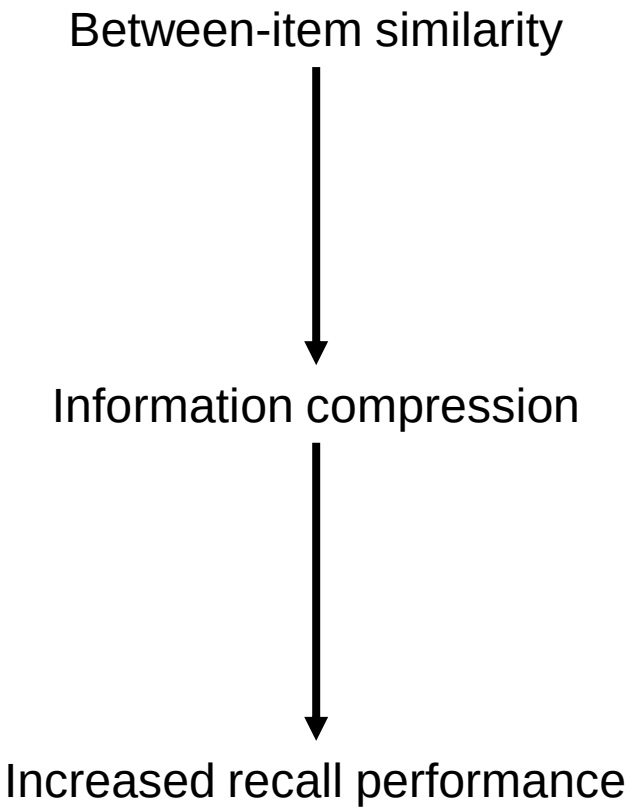
Introduction

Between-item similarity enhances WM performance



Son et al. (2020)

Introduction

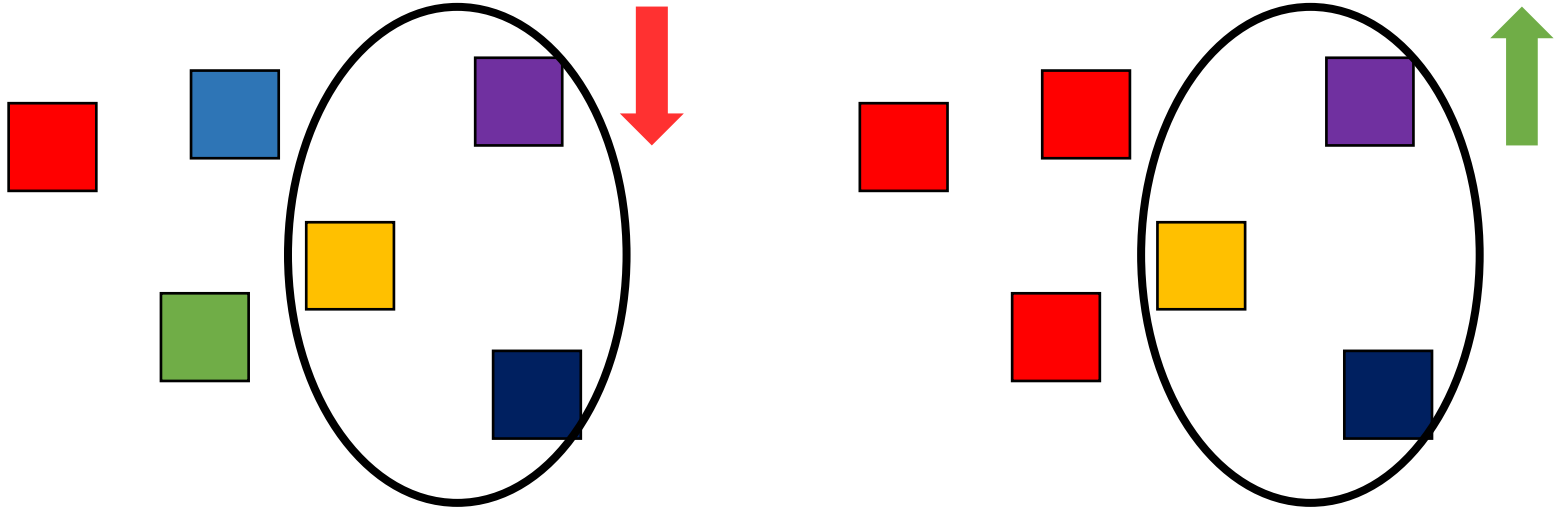


Chekaf et al. (2016)

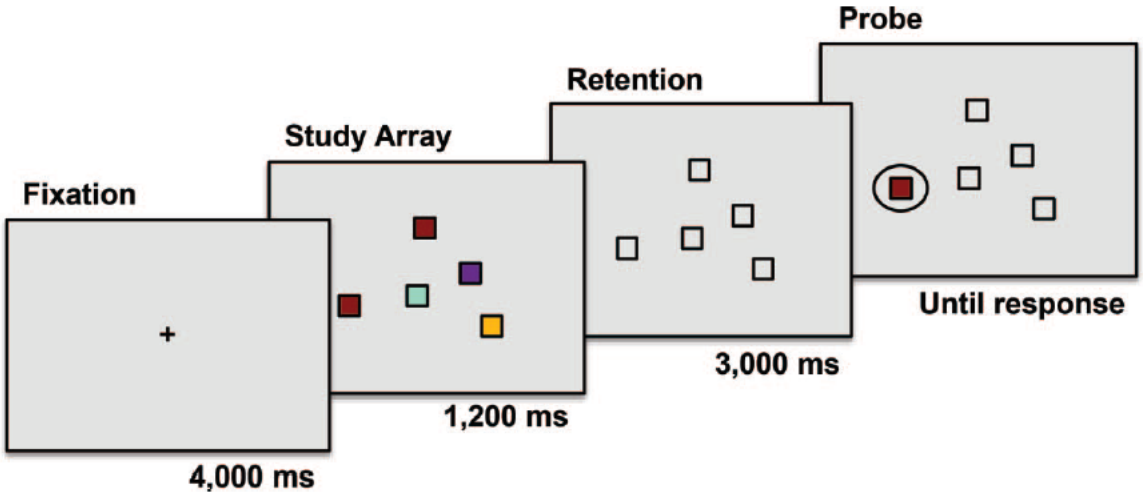
Introduction

Prediction:

Between-item similarity should enhance recall performance for other, non-compressible items.

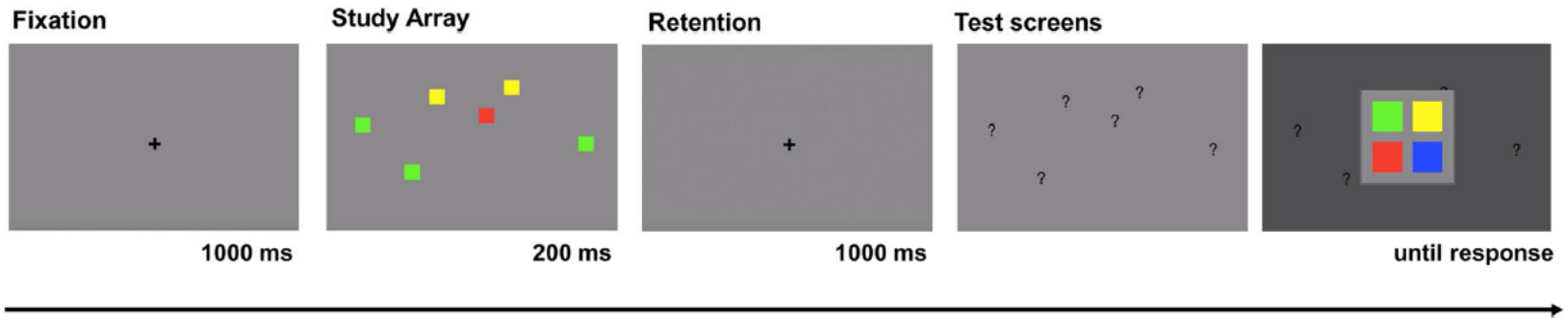


Introduction



Morey et al. (2015)

Introduction



Ramzaoui & Mathy (2021)

Introduction

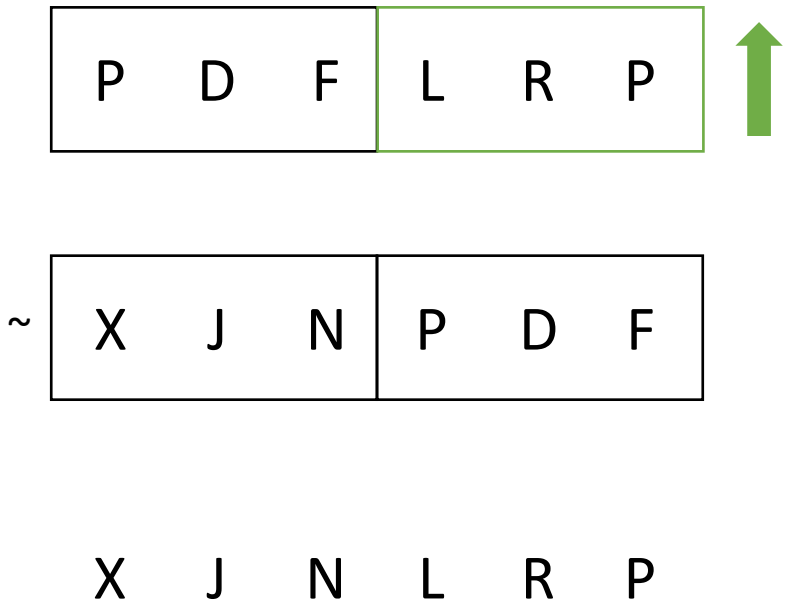
But:

Simultaneous presentation

Sequentiality?

Introduction

Verbal domain - chunk



Thalmann, Souza & Oberauer (2018)

Introduction

Goal:

How does **similarity** interacts with WM **maintenance** processes?

Are those interactions a **domain-general** property?

Methods

Between-item similarity manipulation

Sequential presentation

Sequential recall

2 seconds / item

~ 30 participants / experiment

20 trials / condition

Conditions presented in a pseudorandom order

Methods

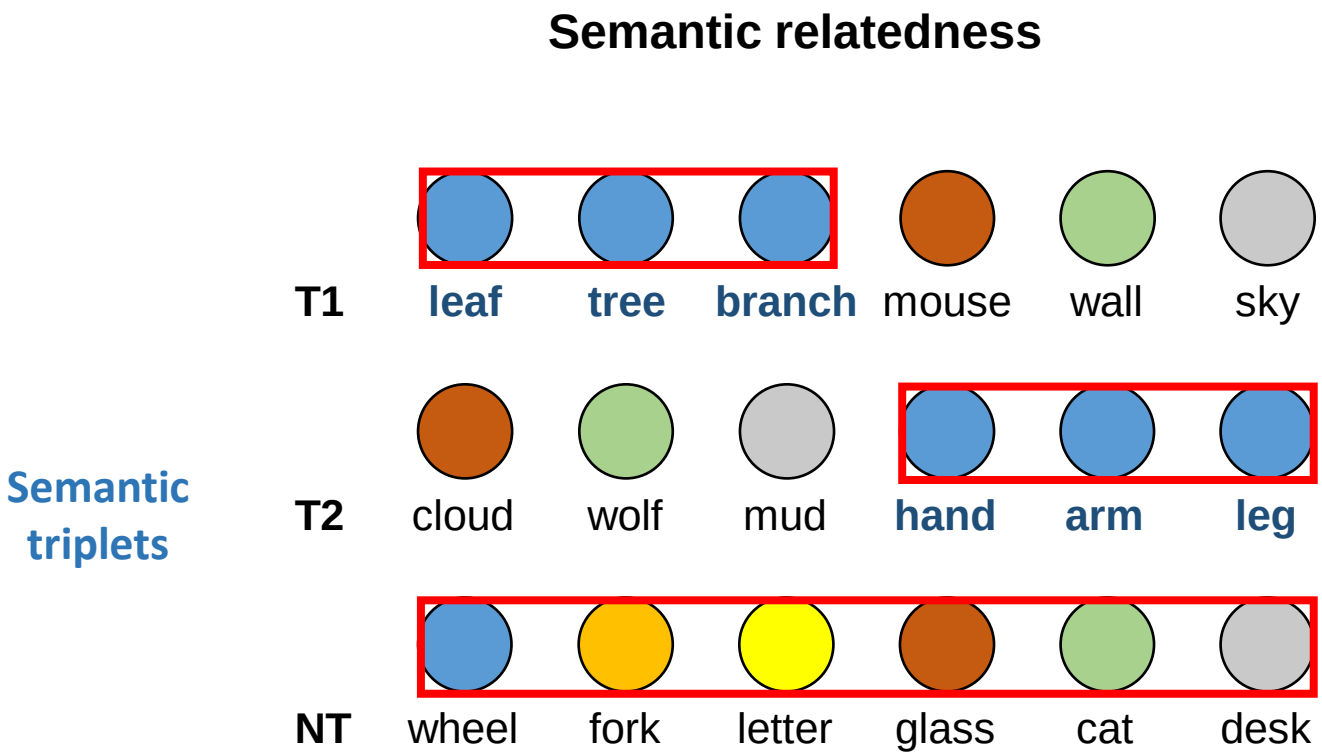
Exp. 1 – Semantic relatedness

Exp. 2 – Rhyming similarity

Exp. 3 – Visuospatial proximity

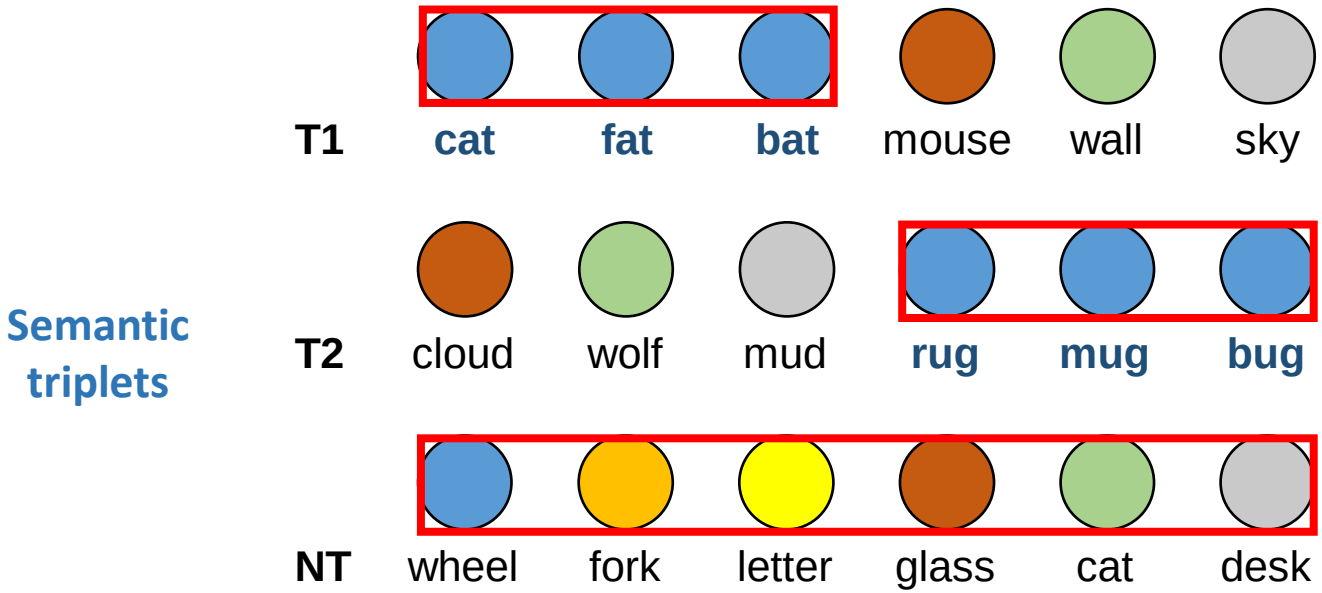
Exp. 4 – Visual similarity

Methods: Exp. 1 – Semantic domain



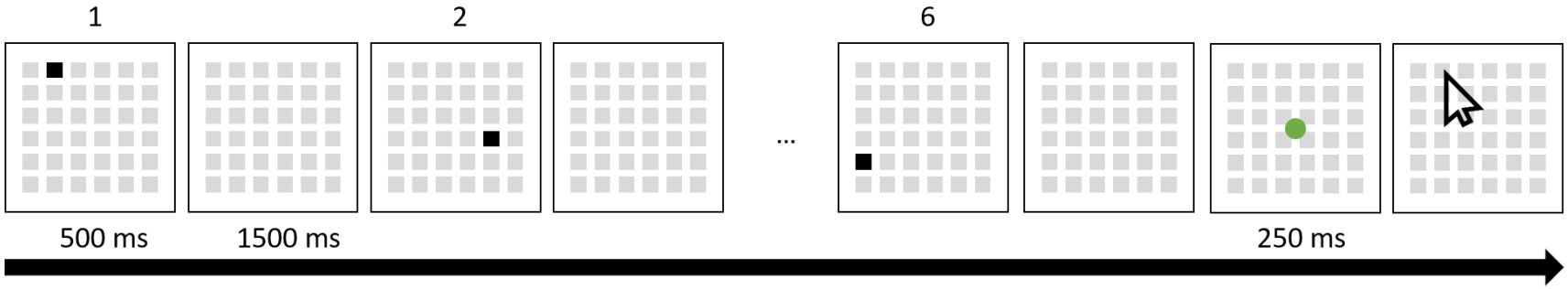
Methods: Exp. 2 – Phonological domain

Rhyming similarity



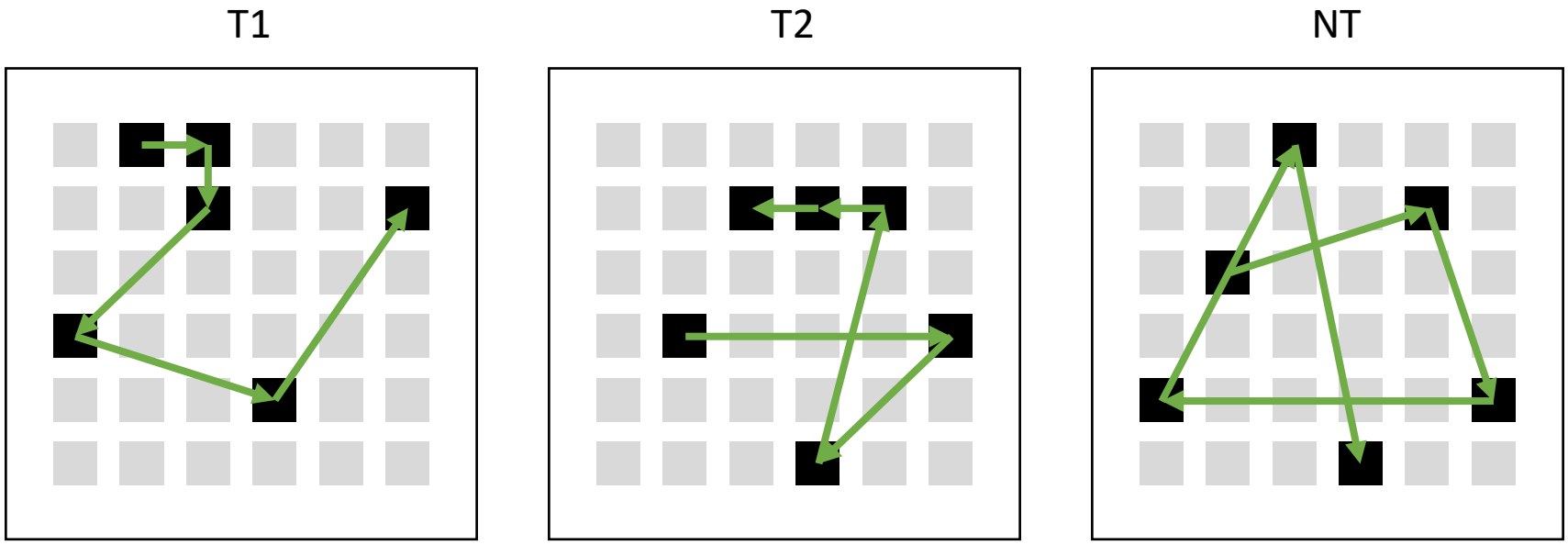
Methods: Exp. 3 – Visuospatial domain

Visuospatial proximity



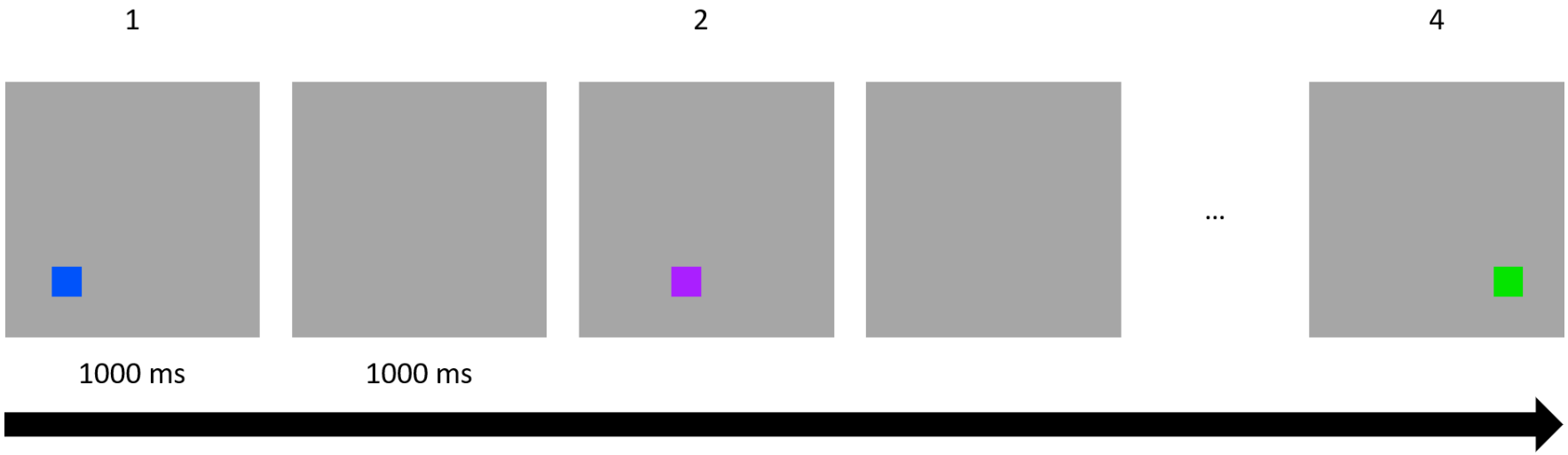
Methods: Exp. 3 – Visuospatial domain

Visuospatial proximity



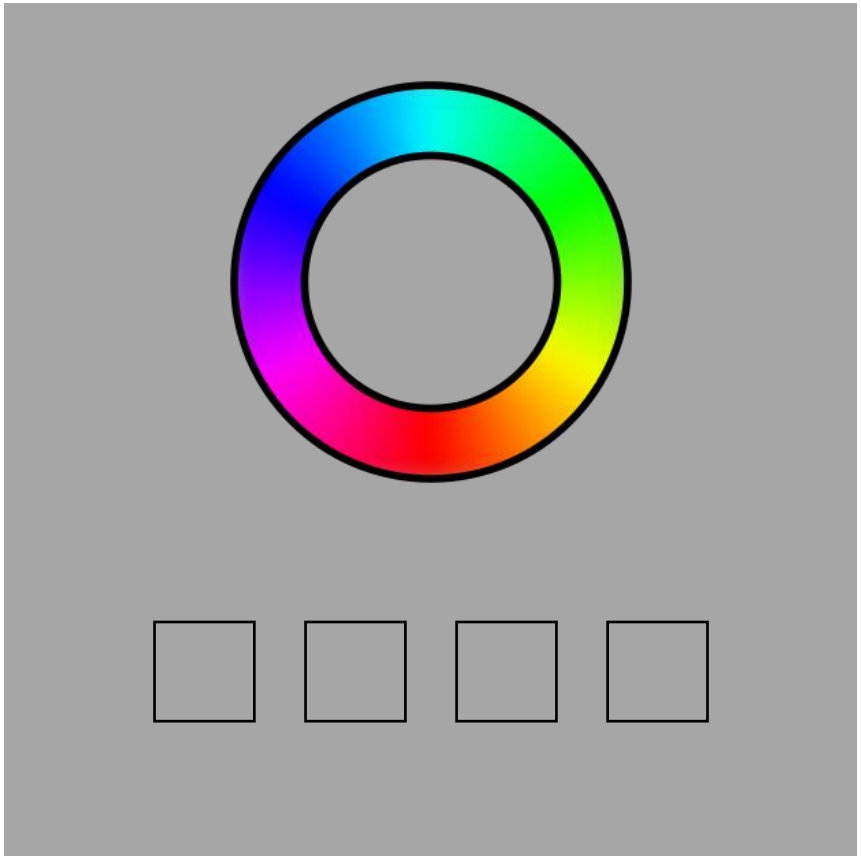
Methods: Exp. 4 – Visual domain

Visual similarity

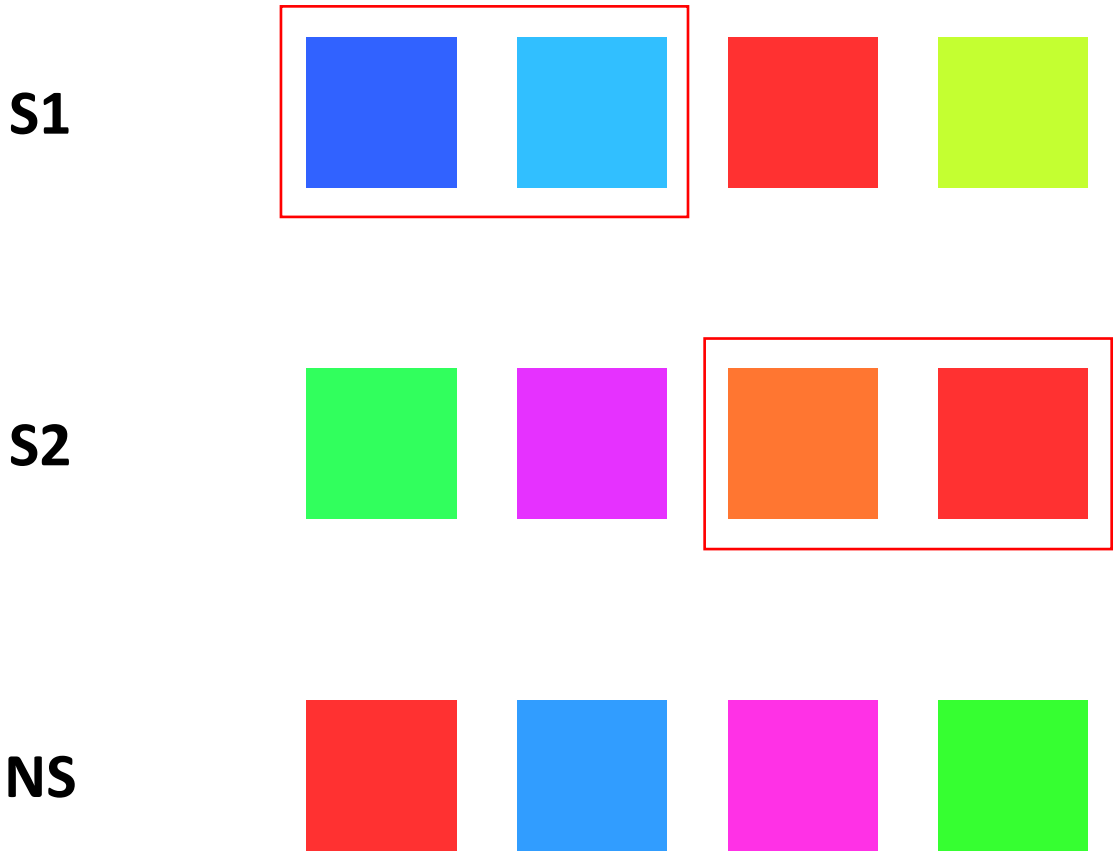


Complex articulatory suppression throughout the task (encoding + recall)
« Ba be bi bo bu »

Methods: Exp. 4 – Visual domain



Methods: Exp. 4 – Visual domain



Results

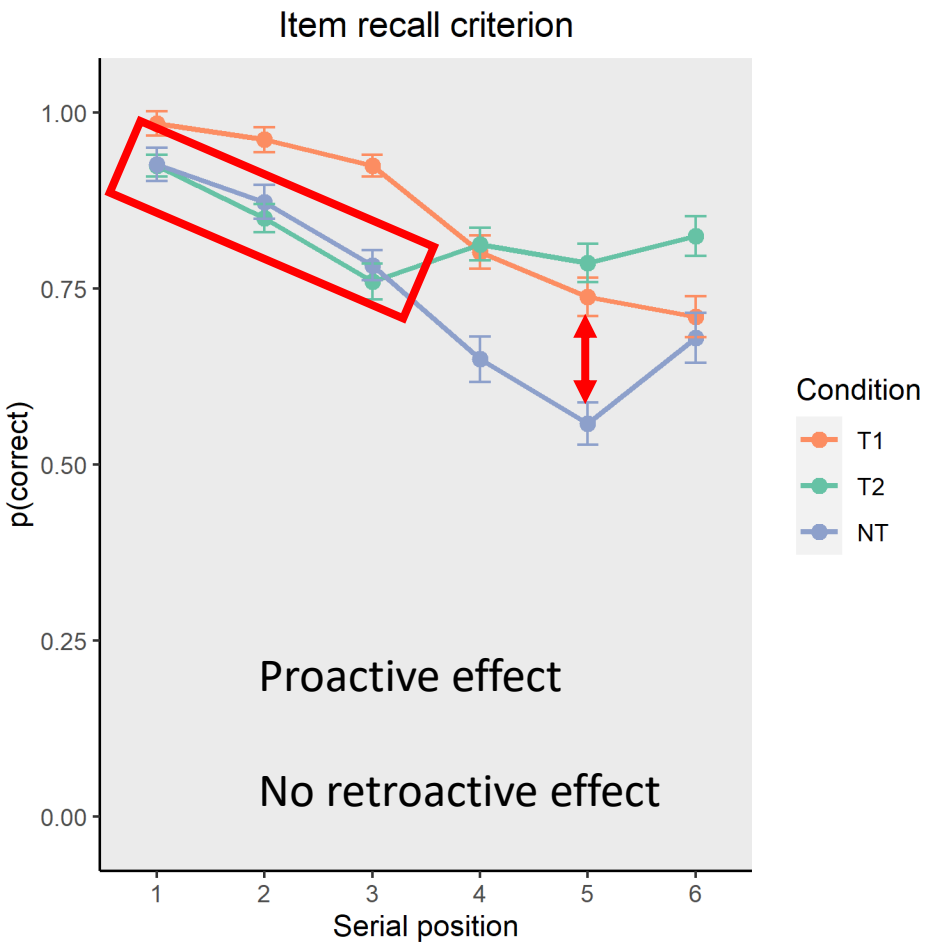
Exp. 1 – Semantic relatedness

Exp. 2 – Rhyming similarity

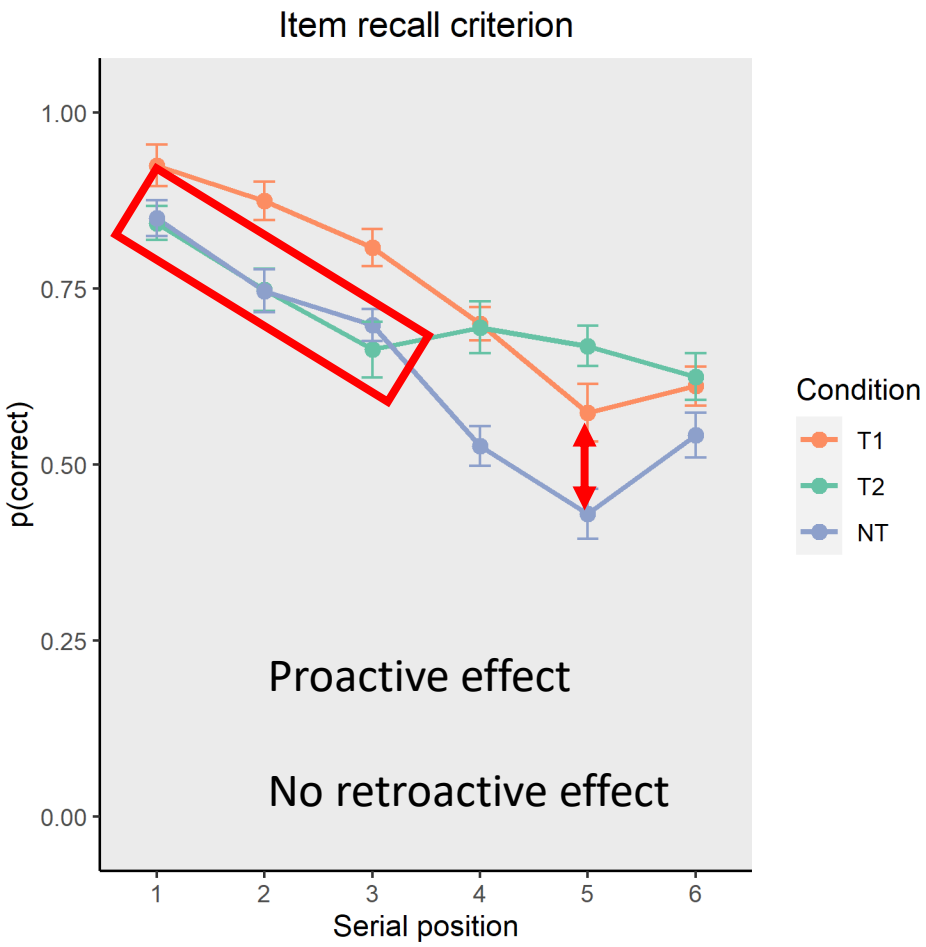
Exp. 3 – Visuospatial proximity

Exp. 4 – Visual similarity

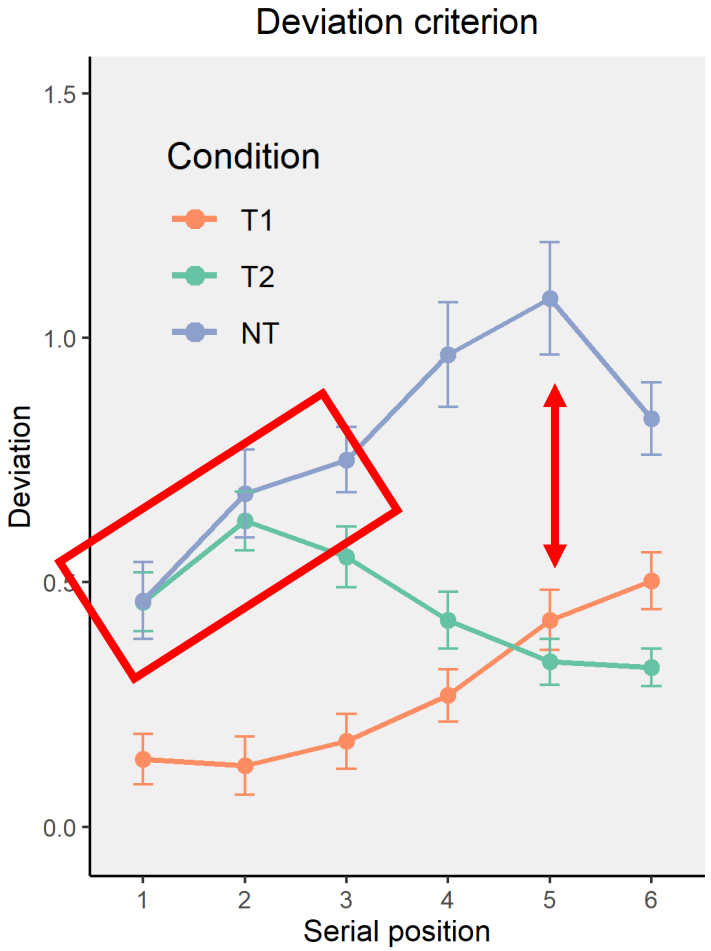
Results: Semantic relatedness



Results: Rhyming similarity



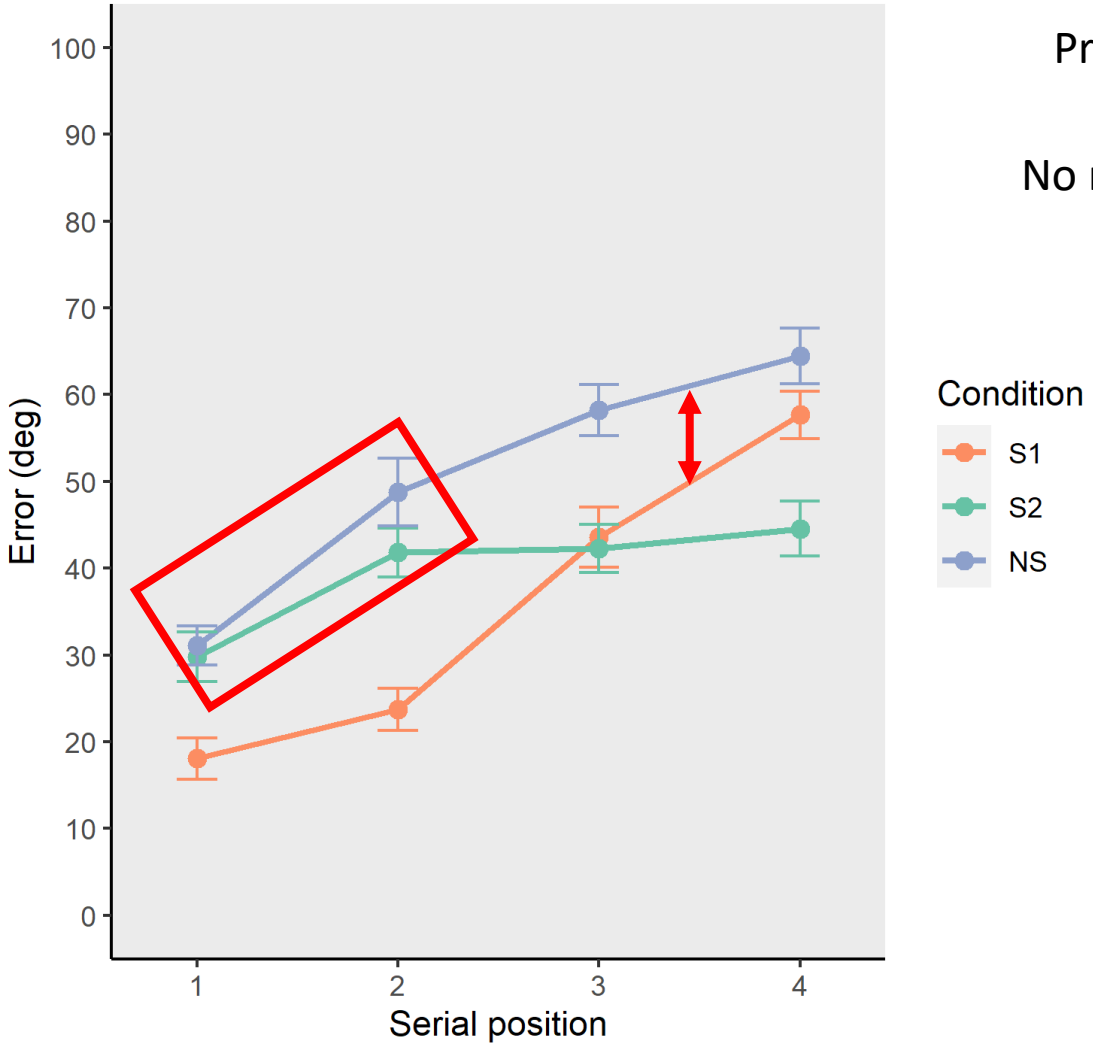
Results: Visuospatial proximity



Proactive effect

No retroactive effect

Results: Visual similarity



Proactive effect

No retroactive effect

Discussion

Between-item similarity:

1. Enhances WM performance.
2. Frees up WM capacity
3. Regardless of the domain tested

Discussion

Challenge of this project:

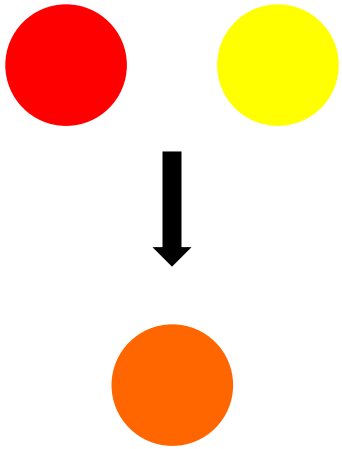
1. Describing similarity mechanisms
2. Describing the maintenance mechanisms

Discussion

Similarity

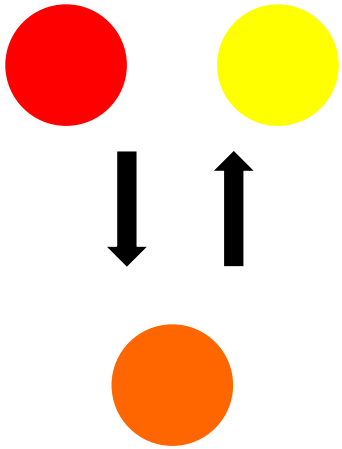
Discussion

Compression
Summary statistics (Alvarez, 2011)



Discussion

Compression
Summary statistics (Alvarez, 2011)



Interactive activation
Dell et al. (1997)

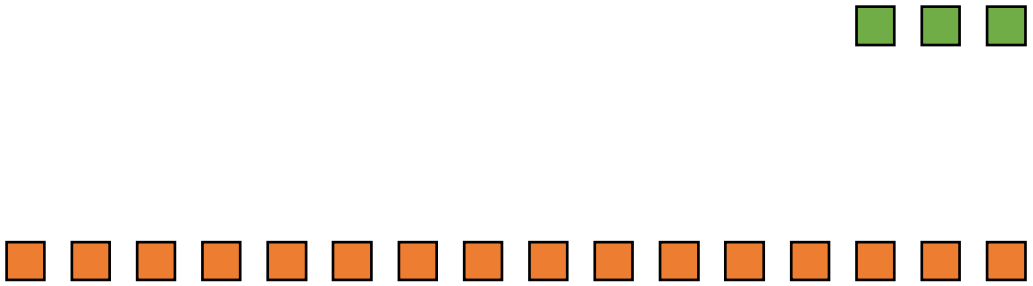
Plausible explanation regarding the semantic relatedness effect
Kowialiewski & Majerus (2020)

Discussion

Reduction of interference via superposition
Oberauer et al. (2016)

Discussion

Reduction of interference via superposition
Oberauer et al. (2016)



Discussion

Reduction of interference via superposition
Oberauer et al. (2016)

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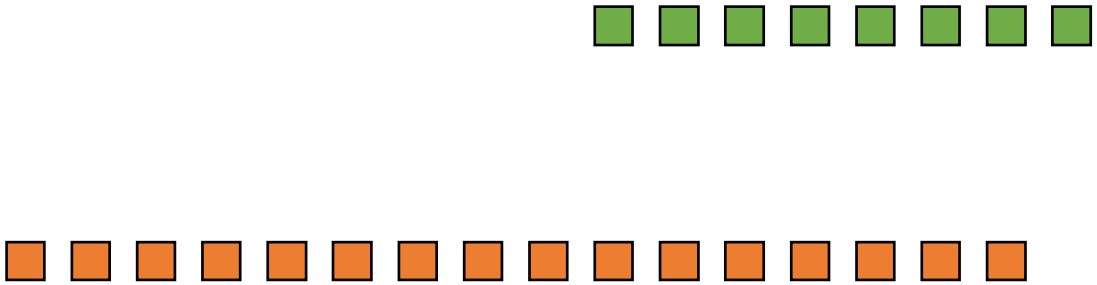
Reduction of interference via superposition
Oberauer et al. (2016)



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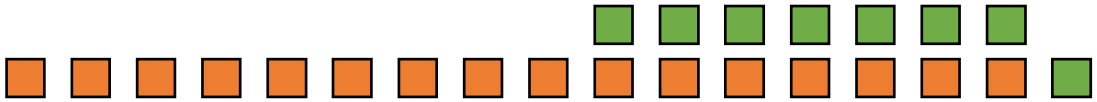
Reduction of interference via superposition
Oberauer et al. (2016)



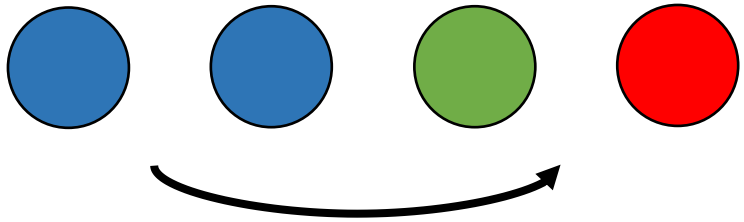
Discussion

Maintenance mechanisms

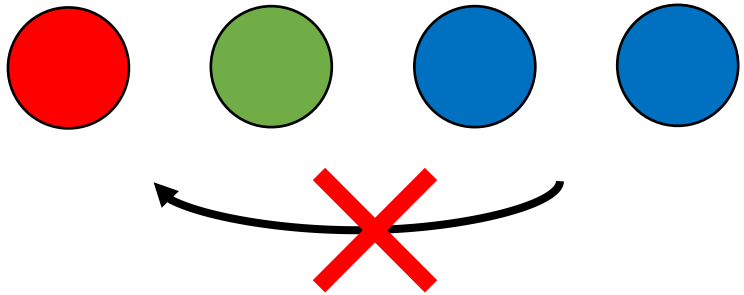
Discussion

Critical role of the temporal dynamics

Proactive impact



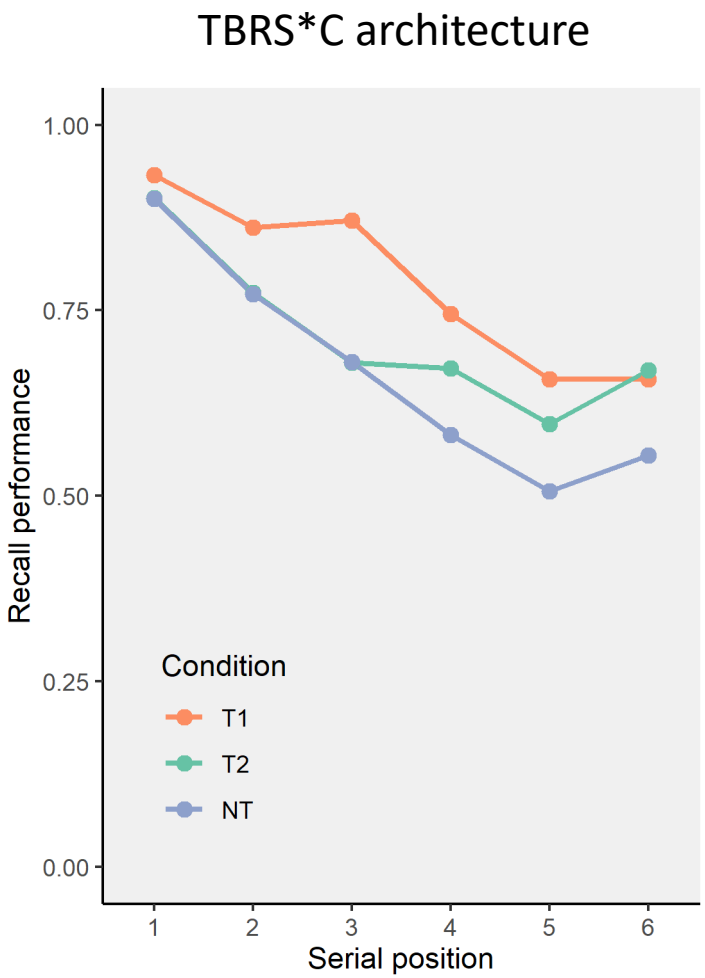
No retroactive impact



Discussion

- Decay & refreshing (Kowialiewski, Lemaire & Portrat, 2021)

Discussion



Kowialiewski, Lemaire & Portrat

(*submitted, but will probably not be included after the 3rd revision, thanks reviewer 3*)

Discussion

- Decay & refreshing (Kowialiewski, Lemaire & Portrat, 2021)

- Output interference (Lovatt et al., 2002)

Error production ➔ Noise ++ or slower recall latencies

Omission errors are empirically slower than correct responses (Kowialiewski, Lemaire & Portrat, 2021)

Discussion

- Decay & refreshing (Kowialiewski, Lemaire & Portrat, 2021)
- Output interference (Lovatt et al., 2002)
- Encoding resource (Popov & Reder, 2020)

Conclusion

Between-item similarity frees up WM capacity

Domain-general property

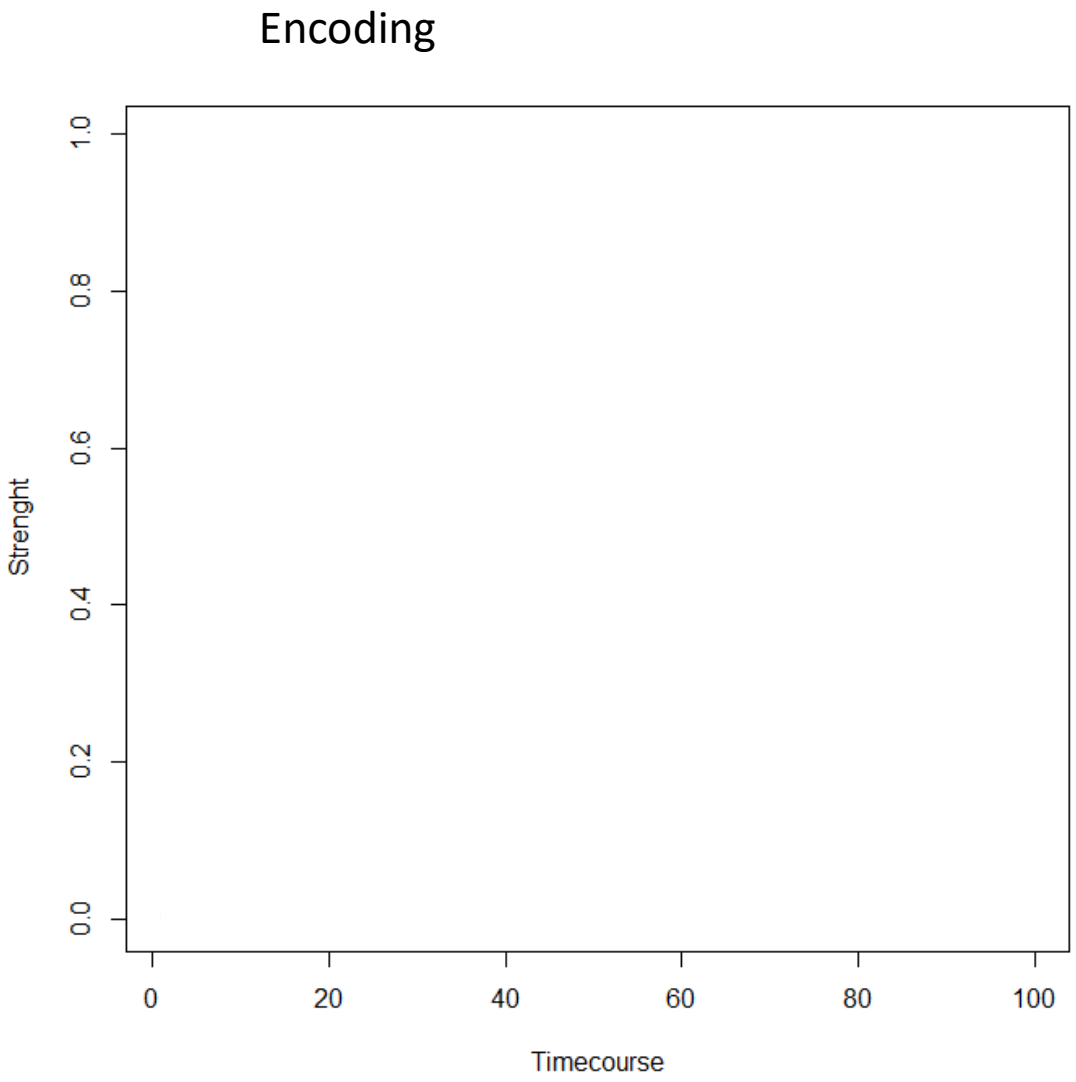
The origin of this free-up effect remains to be formally established

Dr. Sophie Portrat

Dr. Benoît Lemaire

Thank you for your attention

Discussion


Encoding
Strenght
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0.8
1.0
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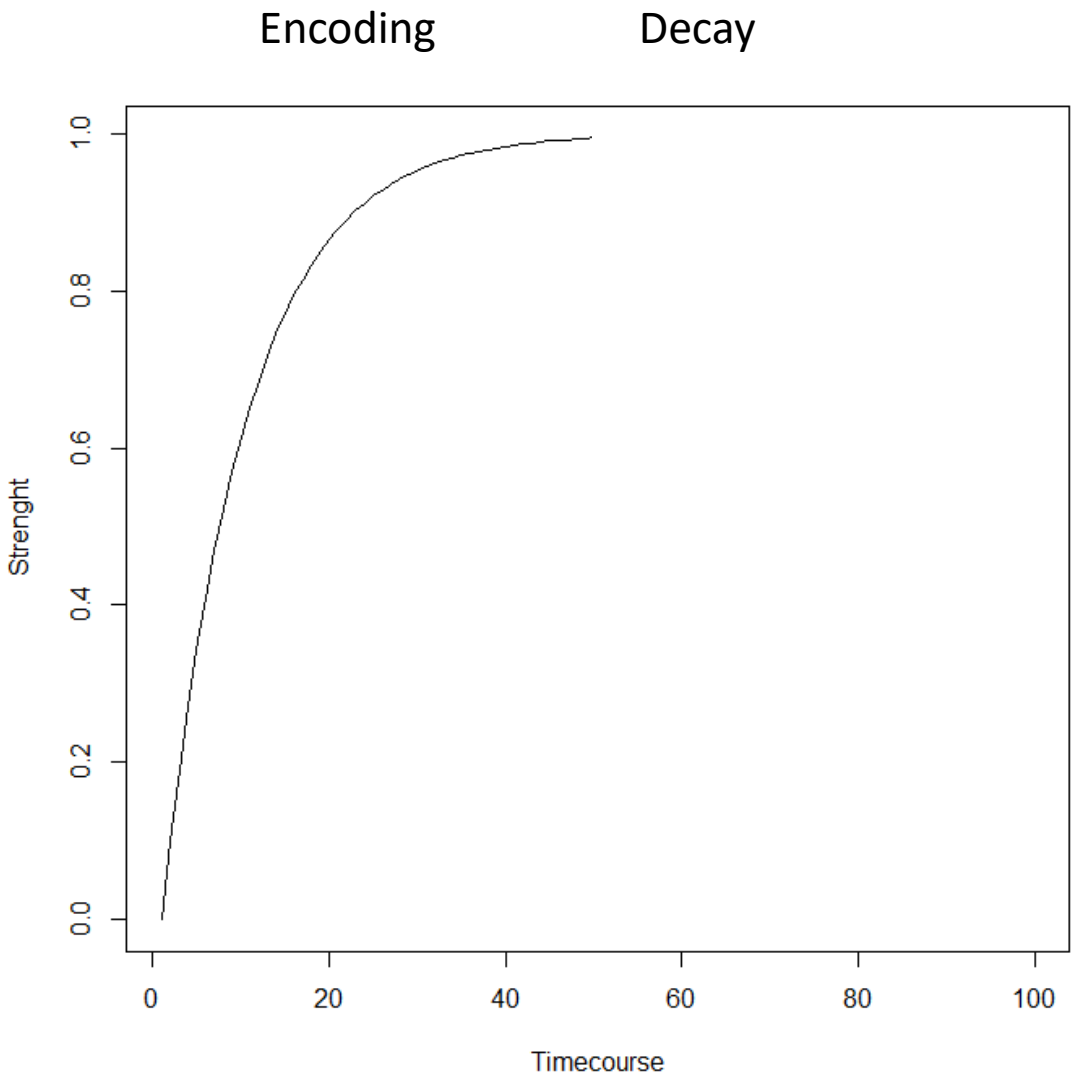
20
40
60
80
100
Timecourse

Discussion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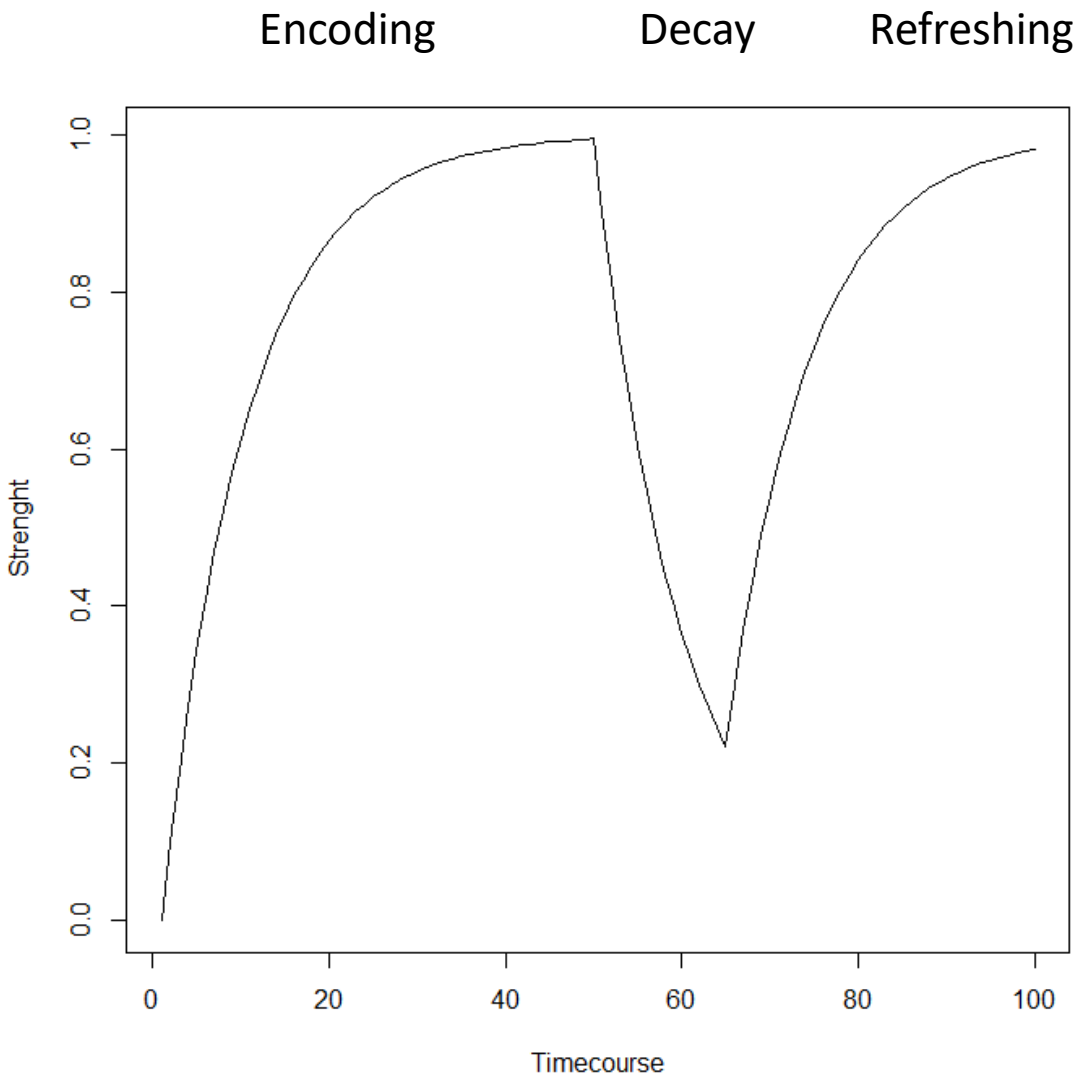
Encoding
Decay
Refreshing
Strenght
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Timecourse

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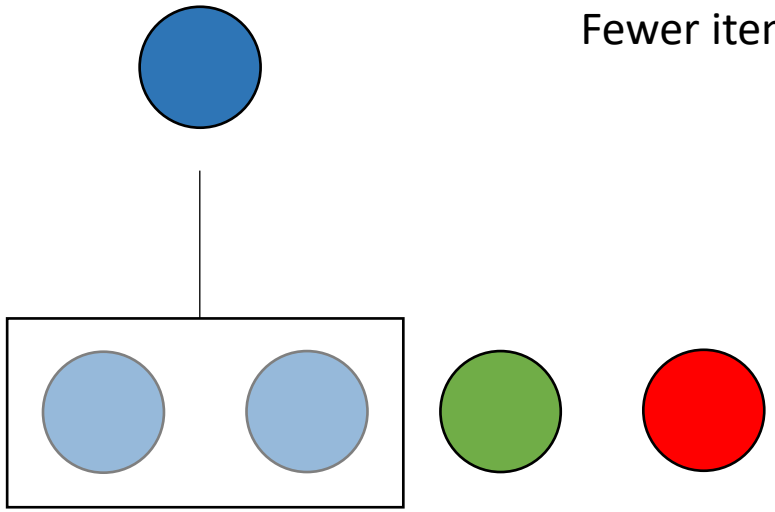
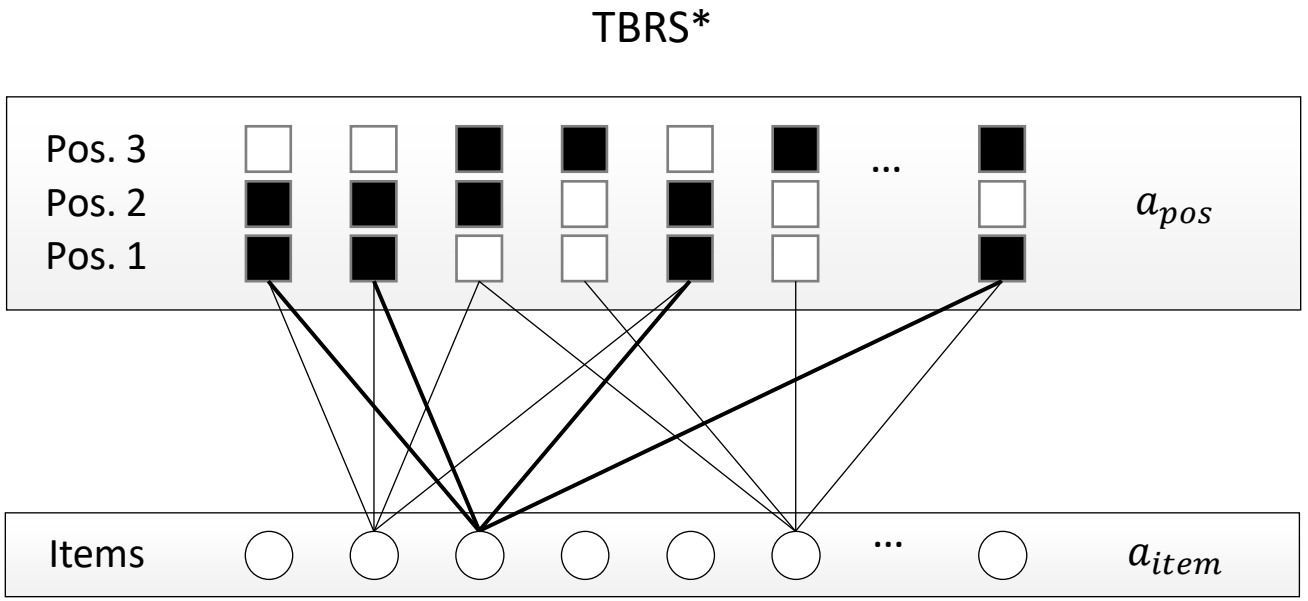


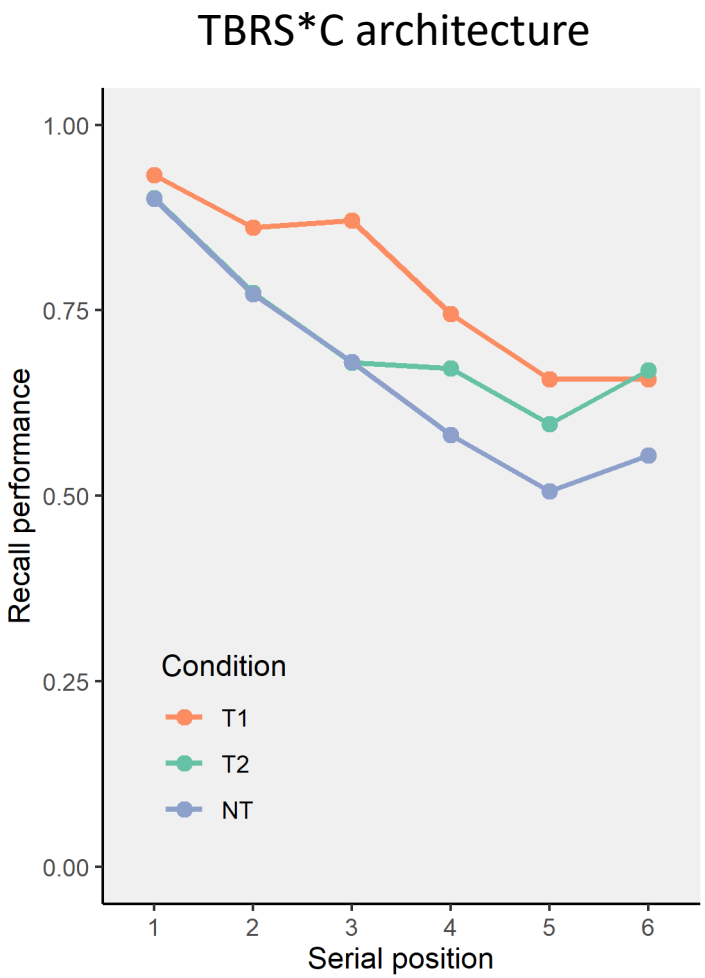
Fewer items to refresh

Discussion



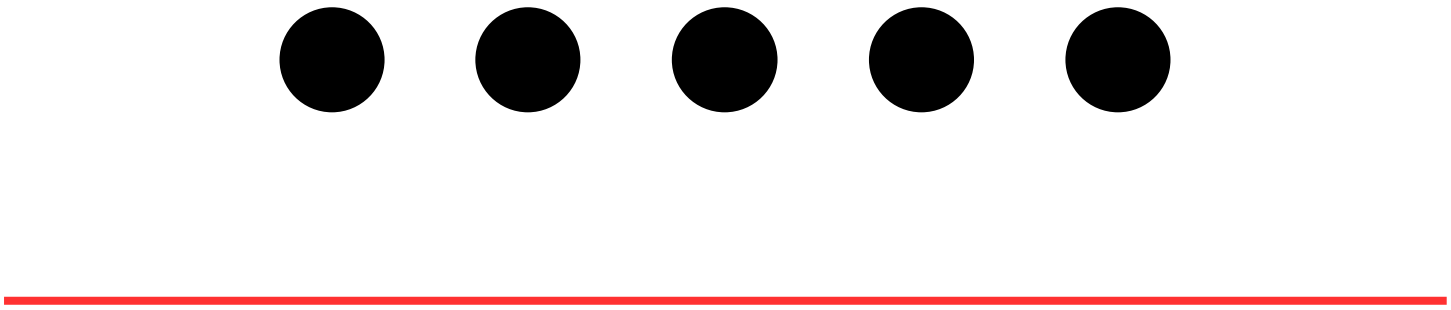
Oberauer & Lewandowsky (2011)

Discussion



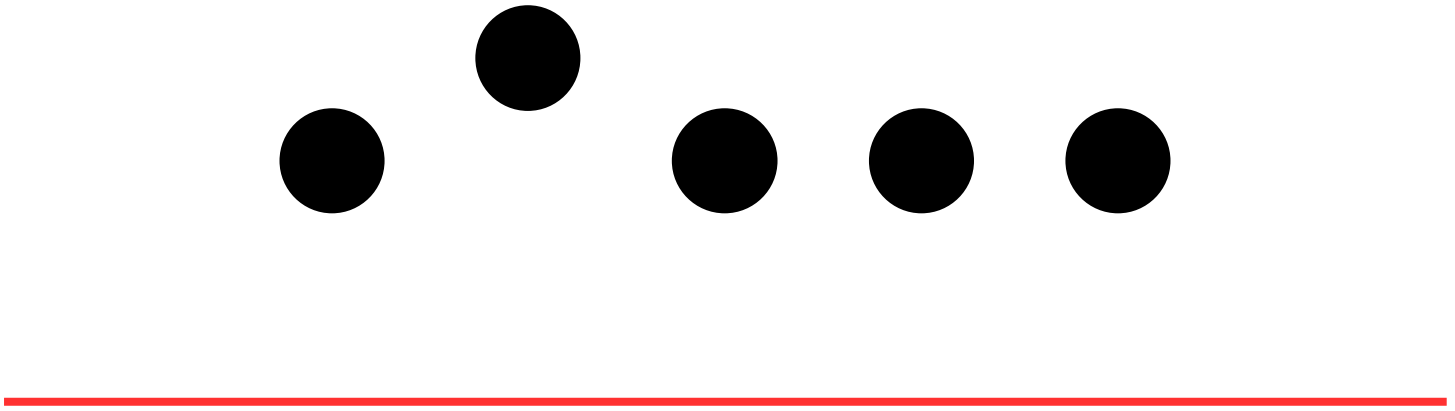
Kowialiewski, Lemaire & Portrat (*submitted*)

Discussion



The juggler metaphor (Kowialiewski, Lemaire & Portrat, 2021)

Discussion



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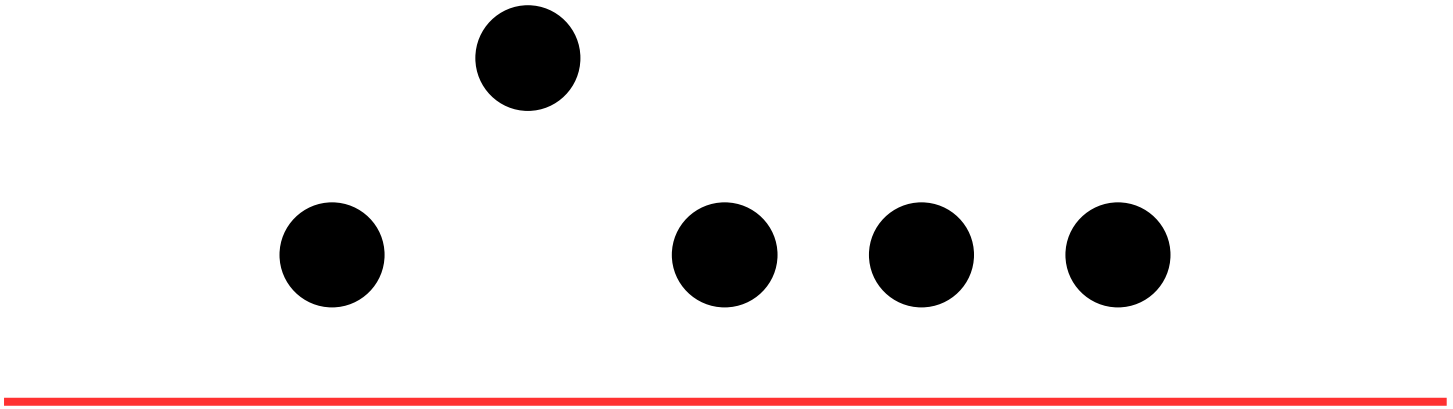

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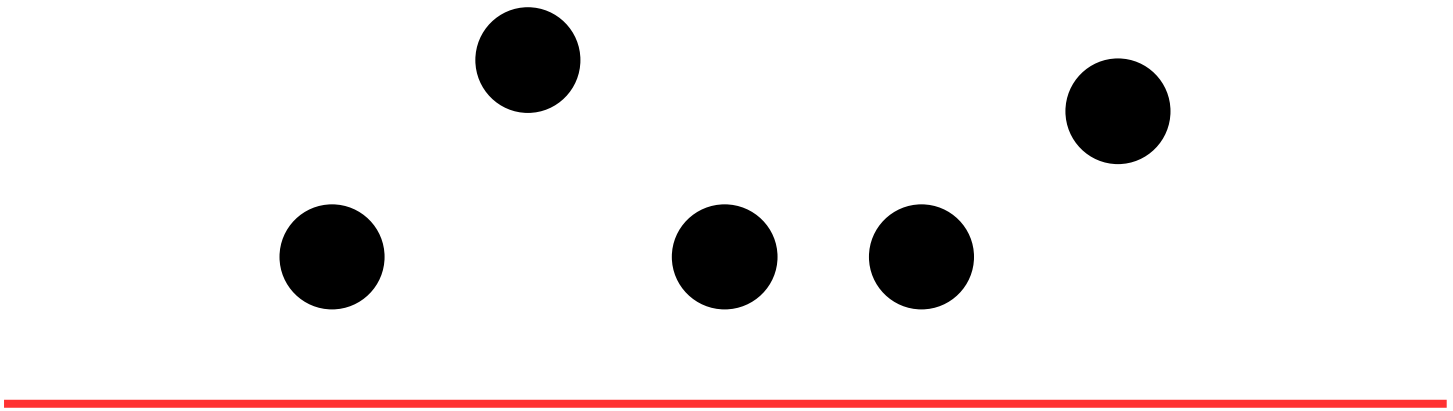

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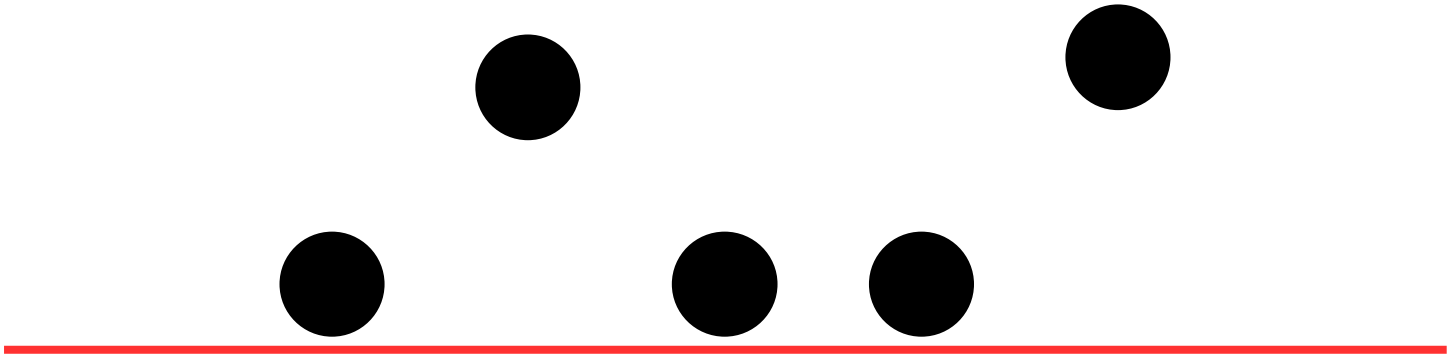

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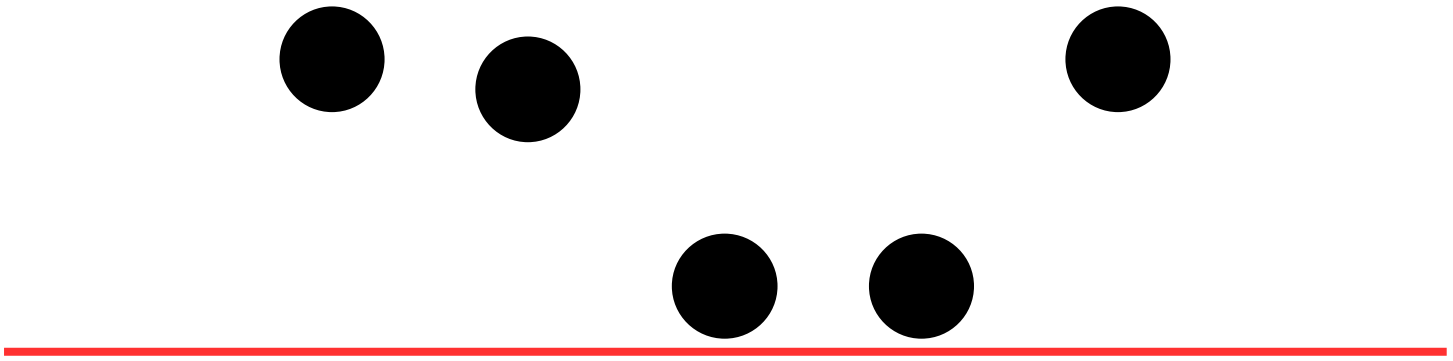

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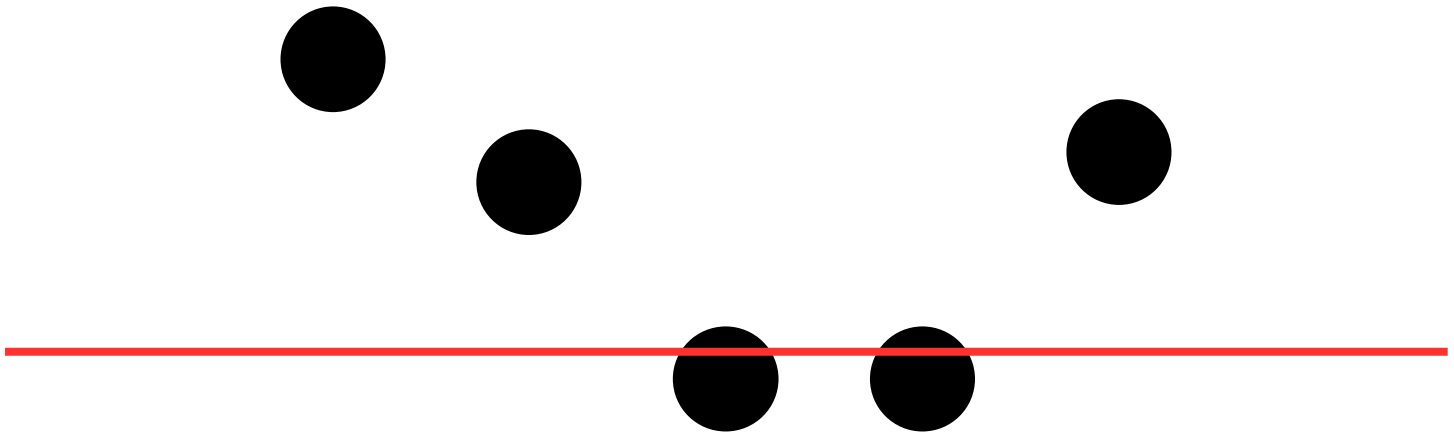

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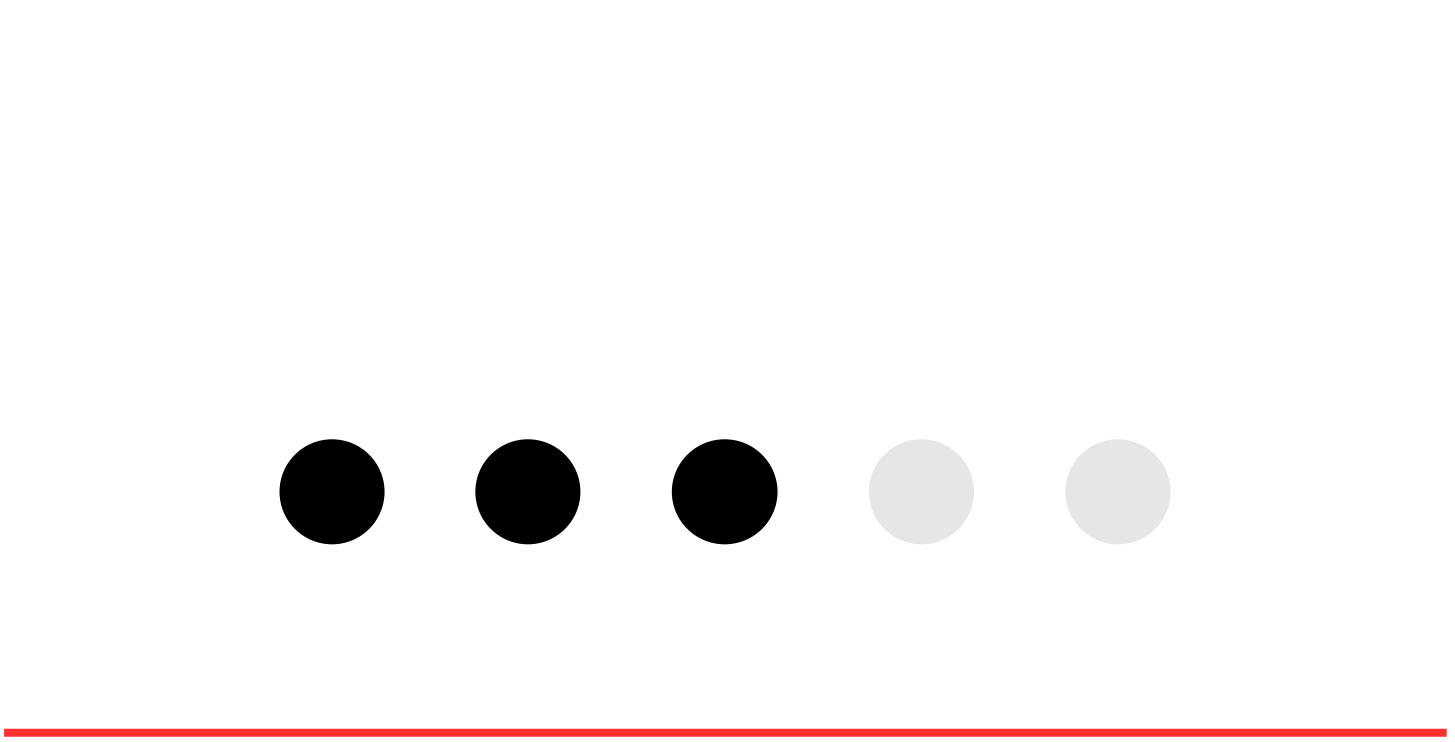

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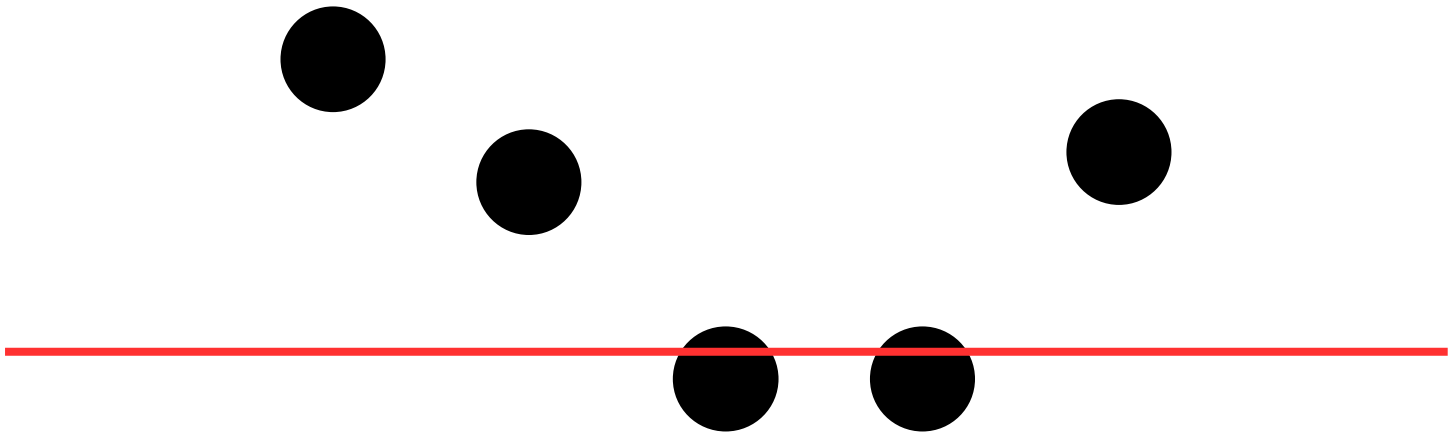

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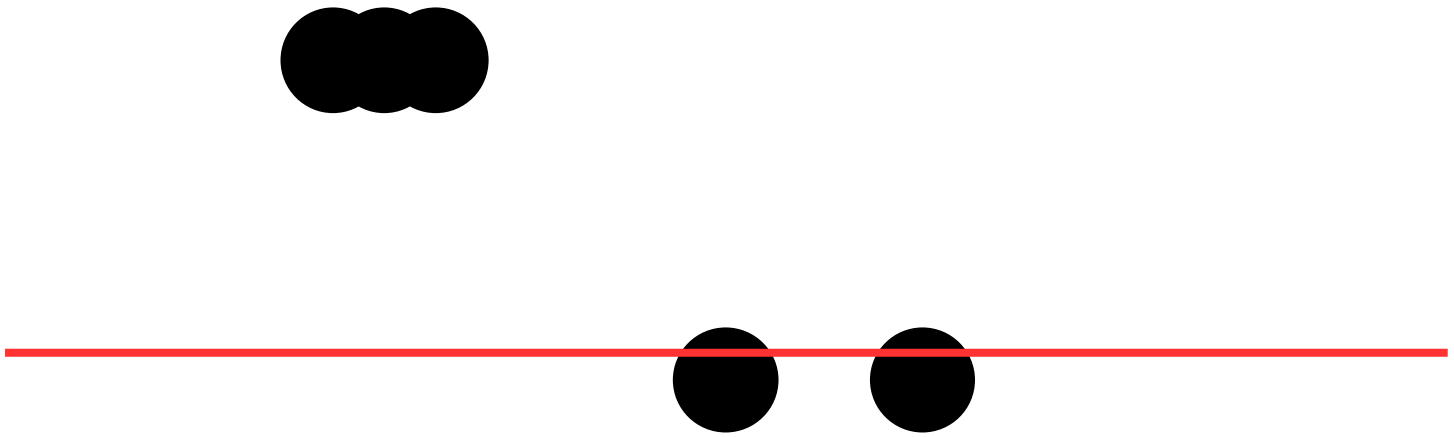

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