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# The Role of Environmental Context in Dementia



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# Outline

- The BIC Model (Diana et al., 2007) and its implications
- The role of Environmental Context (EC)
- EC and Alzheimer's Disease
  
- Just a suggestion I would like to put out there.

# The BIC Model

On the basis of  
**associative memory,**  
**source memory,**  
and  
**remember/know**  
studies.

(Diana et al., 2007)

# Environmental Context

- „A conceptual garbage can“ (Smith et al., 1978)
- Environmental Context (EC): Information in the physical environment, where a stimulus is presented, that is **incidental** to the manner in which the stimulus is encoded.
  - That is, as opposed to **influential context**, which influences the interpretation of the stimulus:  
E.g.                  *Strawberry - Jam*                                  *Traffic - Jam*
- The typical *Global EC* experiment presents subjects with material in one EC and then tests their memory for this material in the same or in a different EC.
  - As opposed to *Local EC*

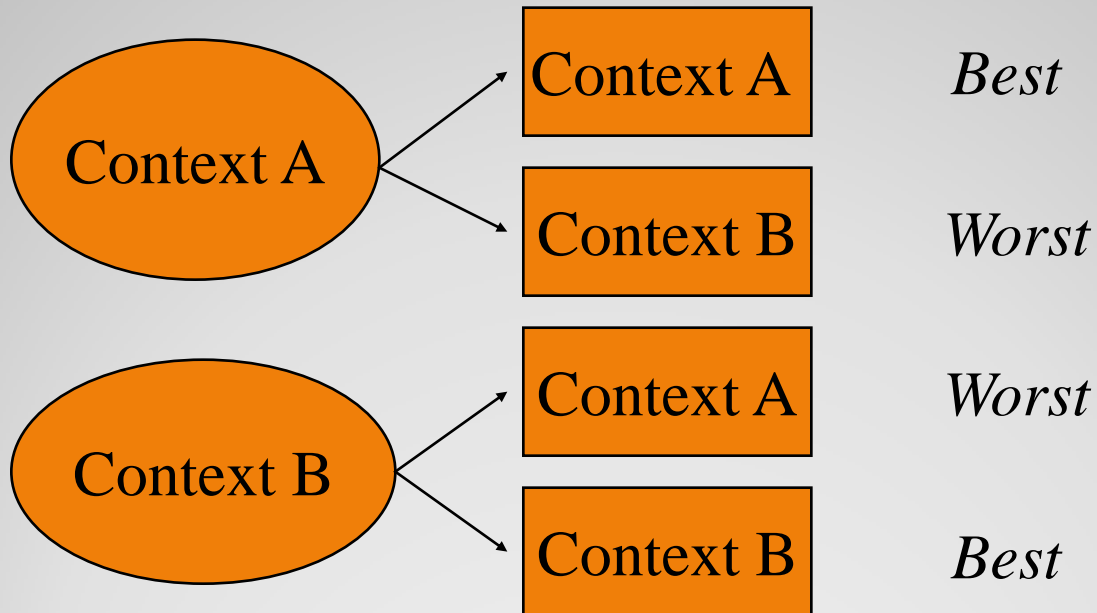
(see also Bjork and Richardson-Klavehn, 1989)

# The Reinstatement Paradigm

Encoding

Retrieval

Performance



## Macken 2002

Tested recognition memory employing a *Local EC* manipulation.

Employed the IRK (Independence Remember Know) procedure (Yonelinas & Jacoby, 1995) assuming that recognition comprises recollection and familiarity (see Yonelinas, 2002).

EC effects for recollection but not for familiarity.

Pattern of results replicated by Markopoulos et al. (2010)

# Unpublished experiment

## Method:

- Sixty-four participants
- Encoding: 80 nouns in EC A or EC B (memorization or natural/man-made task)
- Questionnaire & Partial Test: 20 Targets and 20 Distractors
- Filler task: 15 min drawing task (waiting area)
- Recognition: 32 participants returned to encoding EC and 32 were led to the new EC.
- Item types: 60 P items, 20 T items, 20 D items



EC main effect:  $F(1,60) = 130.436$ ,  $MSE = 0.011$ ,  $p < .001$

Type x EC interaction:  $F(2,120) = 27.278$ ,  $MSE = 0.003$ , Huynh-Feldt  $p < .001$

EC main effect:  $F(1,60) = 152.259$ ,  $MSE = 0.906$ ,  $p < .001$

Type x EC interaction:  $F(2,120) = 14.863$ ,  $MSE = 0.374$ , Huynh-Feldt  $p < .001$

# Unitization hypothesis

- One possible exception to the assumed **context-independence** of familiarity is the 'unitization' of associative information (e.g. context) and item information (Yonelinas, 2002).
- Wais, Mickes & Wixted (2008): Source memory information accompanying **know** responses  
Caldwell & Masson (2001): Familiarity-based recognition of **object-location associations**. The locations were realistic environments (rooms of a house) with which the participants actively interacted.

# Unitization hypothesis

- In contrast to previous findings, **Perirhinal Cortex** has been found to be involved in certain types of associative memory.
- Haskins et al. (2008) observed **Perirhinal Cortex** involvement in memory for novel compound words as opposed to words in sentences (see also Ford et al., 2010; Staresina & Davachi, 2008).
  - In sentence: The \_\_\_ for the bath cost one \_\_\_ **STEAM TOKEN**
  - Novel compound: A pastry eaten by mountain climbers **SLOPE BREAD**

## What's the point?

- All the research discussed so far in terms of neuroimaging is based on memory for context (e.g. Diana et al. 2007), not the influence of context on item memory.
- **BUT**: Hayes et al. (2007)

## Subsequent Memory Paradigm

- PhC at encoding associated with retrieval success at **scene-object** and **scene-scene** conditions.
- PhC at recognition associated with retrieval success at **scene-object** condition (Hit vs Miss) –*Mental Reinstatement?*
- PhC at recognition differentiated between Hits at **scene-object** and Hits at **object-object** conditions.

# EC and Alzheimer's Disease

- AD is progressive with arguably distinct stages (see Braak & Braak, 1991).
- The Entorhinal Cortex is affected early on, signalling the first memory problems.
- As the anterior regions of MTL are affected first (ErC and PrC), while the posterior regions (PhC) are intact, **item memory should be affected, but context-processing should be ok** (see Didic et al., 2001).

# EC and Alzheimer's Disease

- **However**: Evidence that memory for context is impaired early on in AD, while item-based memory is intact
  - **E.g. Dalla Barba (1997)**:
  - AD patients produced fewer *Remember* responses than controls, but did not differ in *Know* responses.
- So, it is assumed that AD patients cannot benefit from context-reinstatement.
  - But this conclusion is based on studies of memory FOR context!



# EC and Alzheimer's Disease

- **SO**: The big question is "*Can AD patients benefit from EC reinstatement despite their poor memory for context?*"
- **ANSWER**: I have no idea!

# EC and Alzheimer's Disease

- **However**: There are 'Hints'
- Barak et al. (2013):
  - Tested Traumatic Brain Injury patients
  - TBI patients have episodic memory impairment similar to early AD
  - Manipulated Global EC (rooms) in the reinstatement paradigm.
  - TBI patients showed EC effects (mostly for free recall, less for cued recall, and not for recognition).
  - TBI patients benefitted more from EC reinstatement than healthy controls.

## Putting it all together...

- Different areas of the MTL seem to be dedicated to the processing of items and of context.
- Even if memory **for context** is impaired, perhaps EC reinstatement can be of benefit.
- Figuring out what the exact mechanisms are for EC reinstatement is crucial.
- Different types of EC might produce different outcomes.