

Researching post-retrieval memory modification using a house-visiting task

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1. Motivation: Exposure based therapy, bypassing PFC (Johnson & Casey, 2015; Monfils & Holms, 2018)
2. House-Visiting Task (Gera, et al., 2019)
3. Future Directions (fMRI, modeling)
4. **Validation of the house-visiting task**

1. Motivation

-**Limitations of exposure-therapy**: involvement of the PFC, short-term effects especially for adolescents (Johnson & Casey, 2015)

E.g. recovery of memory: reinstatement/renewal/spontaneous recovery

-A need for **bypassing PFC** to modify memory (Schiller et al., 2013)

-Post-retrieval extinction training **has longer effects**

<- new learning (inhibitory) vs. modification of old memory?



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Counterconditioning following memory retrieval diminishes the reinstatement of appetitive memories in humans

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Appetitive memories play a crucial role in learning and behavior, but under certain circumstances, such memories become maladaptive and play a vital role in addiction and other psychopathologies. Recent scientific research has demonstrated that memories can be modified following their reactivation through memory retrieval in a process termed memory reconsolidation. Several nonpharmacological behavioral manipulations yielded mixed results in their capacity to alter maladaptive memories in humans. Here, we aimed to translate the promising findings observed in rodents to humans. We constructed a novel three-day procedure using aversive counterconditioning to alter appetitive memories after short memory retrieval. On the first day, we used appetitive conditioning to form appetitive memories. On the second day, we retrieved these appetitive memories in one group (Retrieval group) but not in a second group. Subsequently, all participants underwent counterconditioning. On the third day, we attempted to reinstate the appetitive memories from day one. We observed a significant reduction in the reinstatement of the original appetitive memory when counterconditioning was induced following memory retrieval. Here, we provide a novel human paradigm that models several memory processes and demonstrate memory attenuation when counterconditioned after its retrieval. This paradigm can be used to study complex appetitive memory dynamics, e.g., memory reconsolidation and its underlying brain mechanisms.

2. House-Visiting Task

Why?

- A simple task designed for conditioning/counterconditioning
- Uses both Pavlovian and Instrumental components for maximum association
- Binary choice task-> decision output (other tasks usually measure responses to CS (e.g. skin conductance response to CS associated with fear)).

2. House-Visiting Task (structure)

1. Conditioning (CS-reward)

2. Counterconditioning (CS-loss)

3. Reinstatement

Day 1 - Conditioning

| | | | |
|--------------------------|--|-----------------------|-----------------------|
| Liking Ratings: Baseline | Appetitive Conditioning (32 min, 3 house-monetary gain pairings) | Binary Choice Probe 1 | Liking Ratings Test 1 |
|--------------------------|--|-----------------------|-----------------------|

Day 2 - Counterconditioning

| | | | | |
|---------------------------|--------------------|--|-----------------------|-----------------------|
| Group 1: Memory Retrieval | 12-min filler task | Counterconditioning (32 min, 3 house-monetary loss pairings) | Binary Choice Probe 2 | Liking Ratings Test 2 |
| Group 2: No Retrieval | | | | |

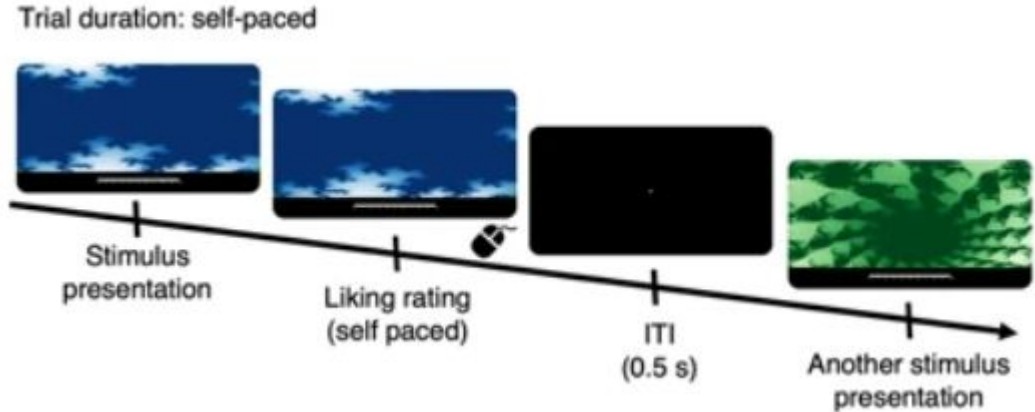
Day 3 - Reinstatement

| | | | |
|---|-----------------------|-----------------------|---|
| Reinstatement (small monetary gain with no house context) | Binary Choice Probe 3 | Liking Ratings Test 3 | Post experiment tasks: Loss aversion assessment, Decelerative memory assessment |
|---|-----------------------|-----------------------|---|

2. House-Visiting Task (procedure)

Day1

Measure baseline preference for
Different fractals (CS stimuli)
->CS+ (CS associated with reward)
: color that's not the most/least preferred



2. House-Visiting Task (procedure)

Day 1

->9 houses(wallpaper color: R/G/B)

->**associate** with reward

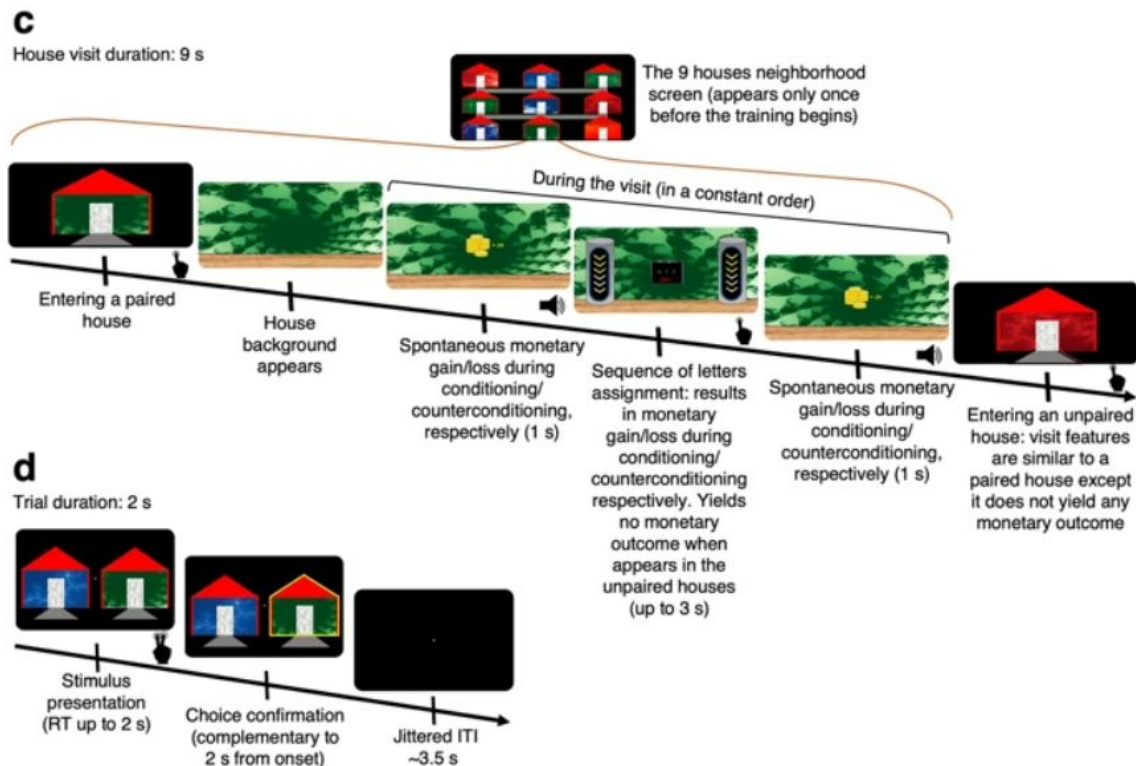
20 block session

Day2

->**counterconditioning**

->associate CS+ with losses

(Group: Retrieval vs. no Retrieval)

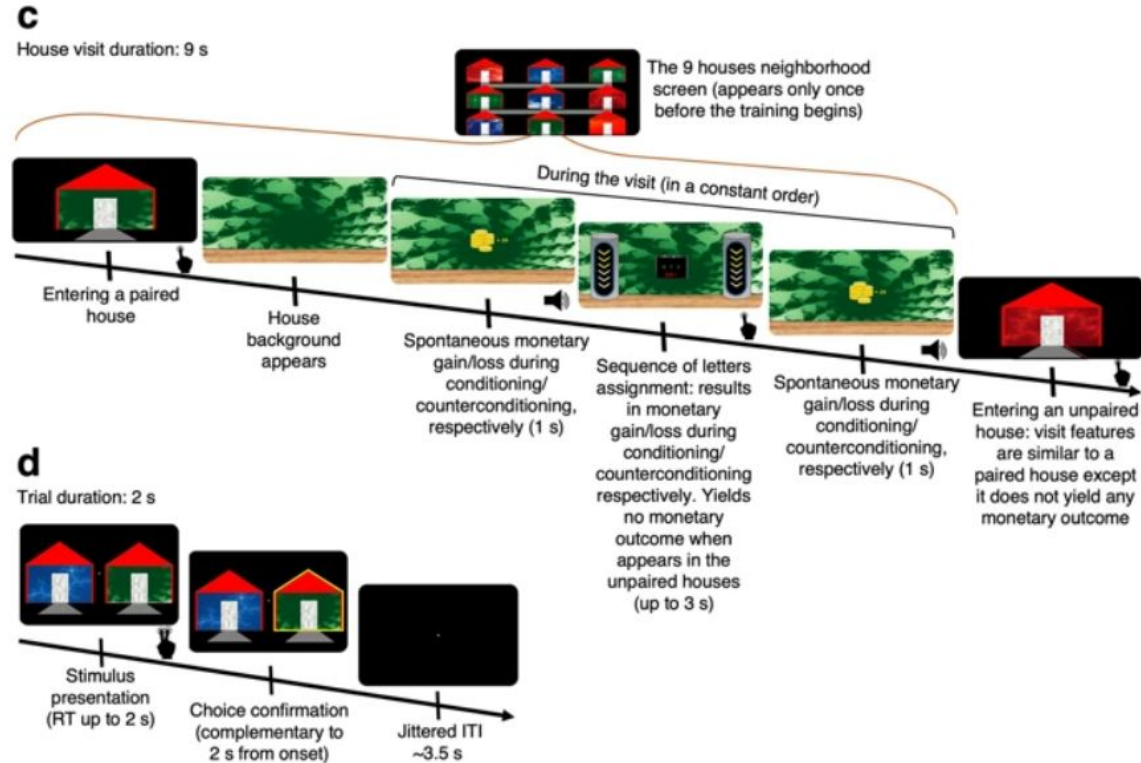


2. House-Visiting Task (procedure)

Day 3

-> **Reinstatement** (brief tour)

-> straight to binary choice task



2. House-Visiting Task

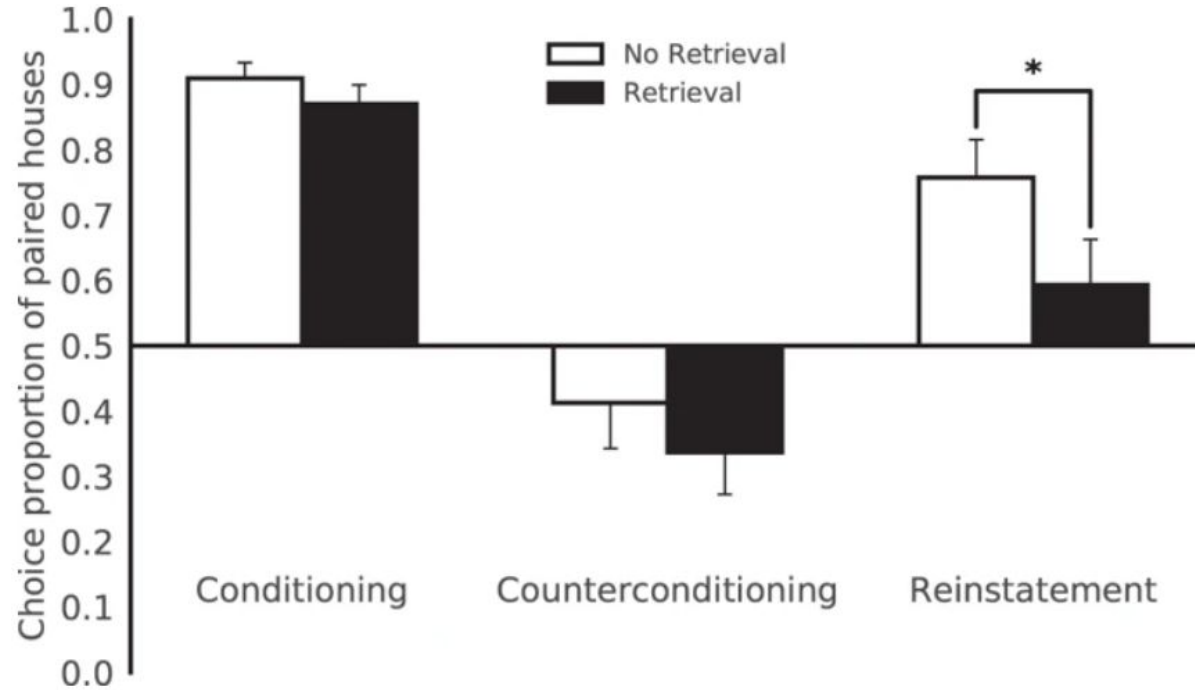
Binary choice task (decide which house they prefer) (Day2, Day3):

- (1) Check whether conditioning happened
- (2) **Logistic Regression(0,1)<- what explains preference of paired house?**

(2): Group X Stage interaction: Conditioning stage-no difference between retrieval/no retrieval condition, Counterconditioning stage-no group difference, but uniformly avoided CS+(manipulation check), Reinstatement stage- both groups show reinstatement, but **lower reinstatement in retrieval condition.**

<- not explained by loss aversion differences, no difference in liking report

2. House-Visiting Task



3. Future Directions

- Experimentally manipulate post-retrieval memory modification for appetitive stimuli
- Clinical applications (SUD?)
- Other methods than counterconditioning (Extinction session? Propranolol? Neuro-feedback?)
- How to ensure conditioning/counterconditioning learning? (40% was excluded in paper)
- Does it work with fear memory? (with a relatively narrower neurological basis)
- BUT relatively new task -> further validation needed**

4. Validation

1. task code (not shared... yet) -> implement to psychopy?
2. Individual differences within Group 1 -> does it predict changes in decision making (binary choice task)?

-> possibility for modeling (Gershman et al., 2017) later on?
3. Threat memory -> neuroimaging? (PFC vs. amygdala activation)

References

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