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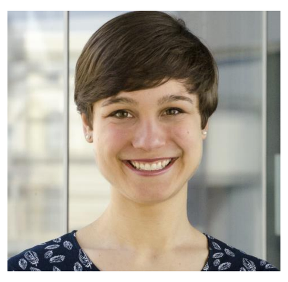

Do wanting, hunger and brain microstructure predict recognition performance and lure discrimination of food items? – Results of a pre-registered analysis

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Background

- Unhealthy food decisions: major contributor to global obesity pandemic[1]
- Food decisions influenced by wanting, hunger[2] and memory processes
- Implicated brain regions:
  - hippocampus (HC): recognition memory[3] and lure discrimination[4]
  - amygdala (Amy)[5] and entorhinal cortex (EC)[6] input to HC: emotional value and hunger
  - orbitofrontal cortex (OFC): reward processing[7]
  - uncinate fasciculus (UF): fiber bundle connecting OFC and Amy & EC[8]

→ Possible top-down modulatory control of food memory by UF

Conclusions

1. Food more relevant in every-day-life than art
2. Previously detected effect of hunger on food memory not reproducible → possibly due to missing sated state as contrast condition
3. (Food) recognition enhanced by prior attribution of wanting to single items but wanting effect possibly averaged out during categorisation
4. Microstructure of UF neither moderator of wanting enhancement nor influencing memory → activity of OFC and HC, Amy and EC possibly more crucial for memory than structure of connection

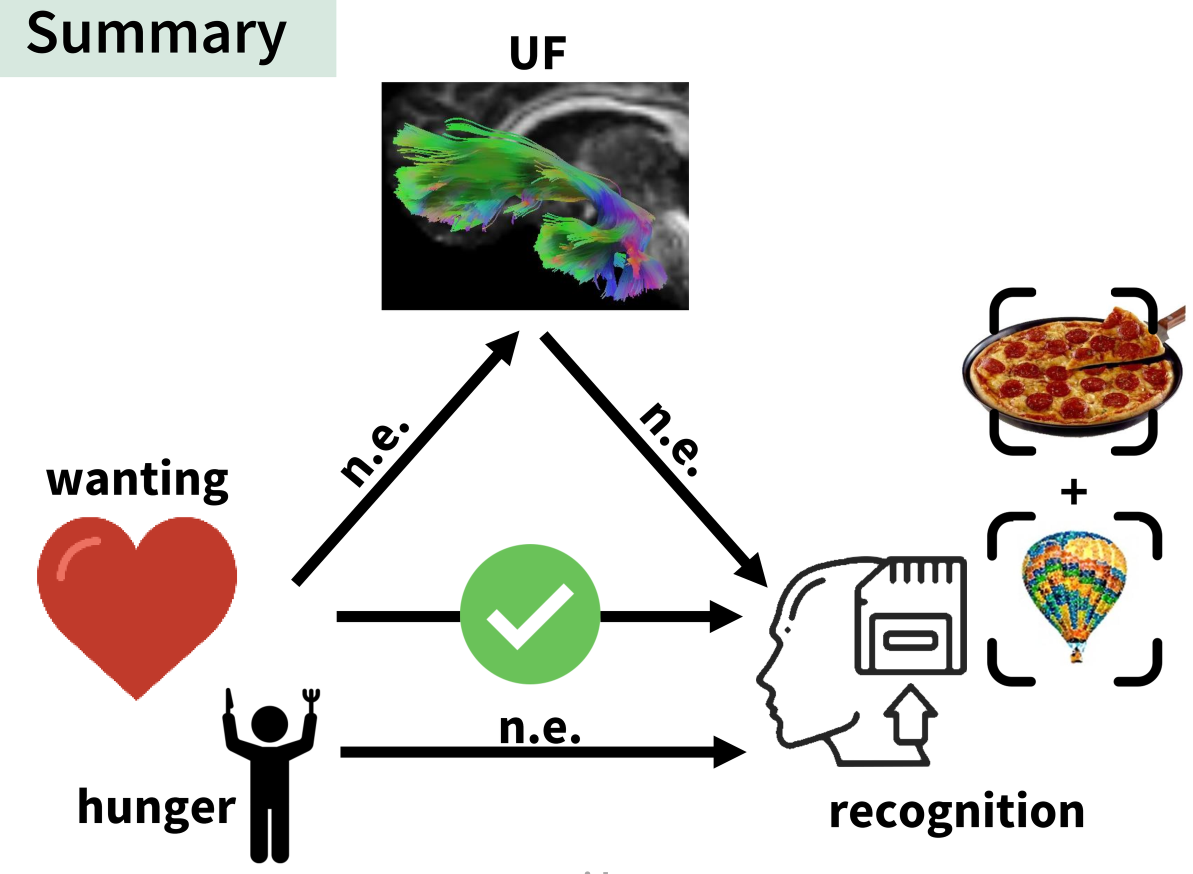
★ New insights in vicious cycle: food wanting increases food recognition
→ wanting and memory influence unhealthy food decisions
→ approaches for neurobehavioural weight-loss therapies

Research Questions

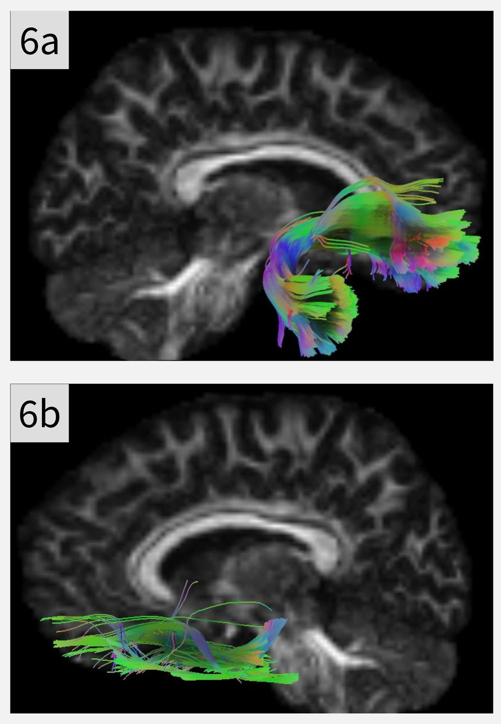
1. Is recognition* of food better compared to art?
2. Does subjective hunger level moderate food recognition*?
3. Is the recognition* of food enhanced by wanting?
4. Does the UF or a sub-bundle influence food recognition* or moderate any of the other effects (hunger, wanting)?

* Are these possible effects and moderations identical regarding lure discrimination performance?

Summary



Neuroimaging Results



4 The microstructural integrity neither of the UF (Fig. 6a) nor of a sub-bundle (Fig. 6b) moderates the wanting enhancement of response accuracy. Neither do they influence target recognition or lure discrimination performance by themselves.

Fig. 6: Right UF (a) and left sub-bundle of UF (b). Examplary tractography results from two subjects.

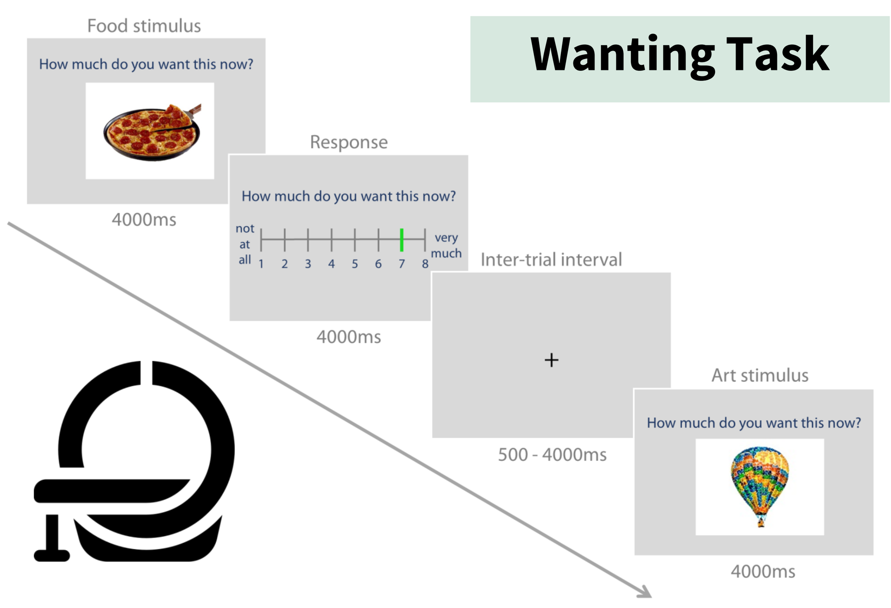
Methods

Study population: n = 60 (20f)

Inclusion:
- 18-45 years of age
- body-mass-index: 25-30 kg/m²
- omnivorous diet
- females: on hormonal contraception

Exclusion:
- restrictive eating (vegan, vegetarian, allergies, eating disorder, …)
- neurological or psychiatric disease

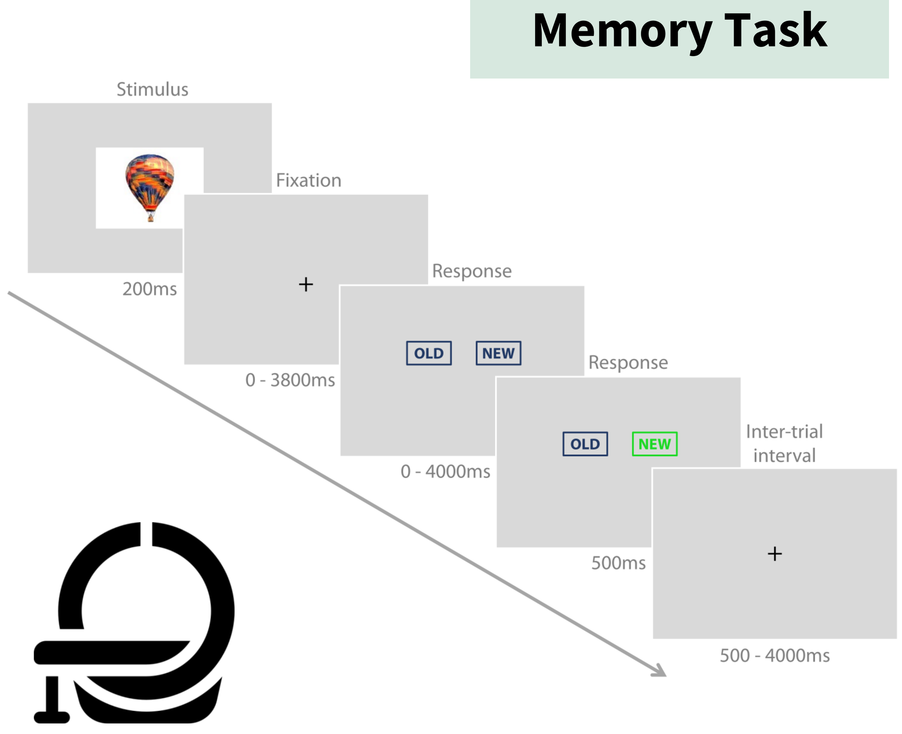
Wanting Task



Stimuli: 80 food and 80 art

Outcome measures:
- wanting rating on 8-point-Lickert-scale
- pre- & post-task hunger rating

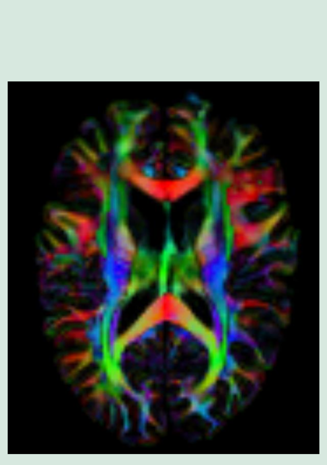
Memory Task



Stimuli: 80 food and 80 art incl. 30 targets, 30 lures and 20 novels per stimulus type

Outcome measures:
- *d' = z (hit rate) – z (false alarm rate) = z (p("old" | target)) – z (p("old" | lure/novel))*
- *LDI = z (correct rejection of lures rate) – z (miss rate)*
- *Response accuracy = hit rate + correct rejection rate*
- pre- & post-task hunger rating

Diffusion-weighted imaging (3T, (1.7mm)³)



- model-free fiber reconstruction with generalized q-sampling (GQI)[9]
- tractography of entire UF:
  - seed region: UF from JHU atlas
  - end region: OFC and PFC (Brodmann areas 10, 11 & 47)[10]
- tractography of sub-bundle of UF:
  - seed region: OFC
  - end regions: amygdala or entorhinal cortex

Behavioural Results

1. Food is better recognized and discriminated than art (**Fig. 1**).
2. Subjective hunger level does not affect food memory performance.
3. Wanting categories do not predict recognition or lure discrimination performance (**Fig. 2**). However, single item wanting enhances response accuracy (**Fig. 3**). The enhancement is strongest in old images, i.e. during memory encoding (**Fig. 4**). Odds ratios (exponentiated β) reveal the evident wanting effect and the memory performance differences between image categories and old, similar and new images (**Fig. 5**).

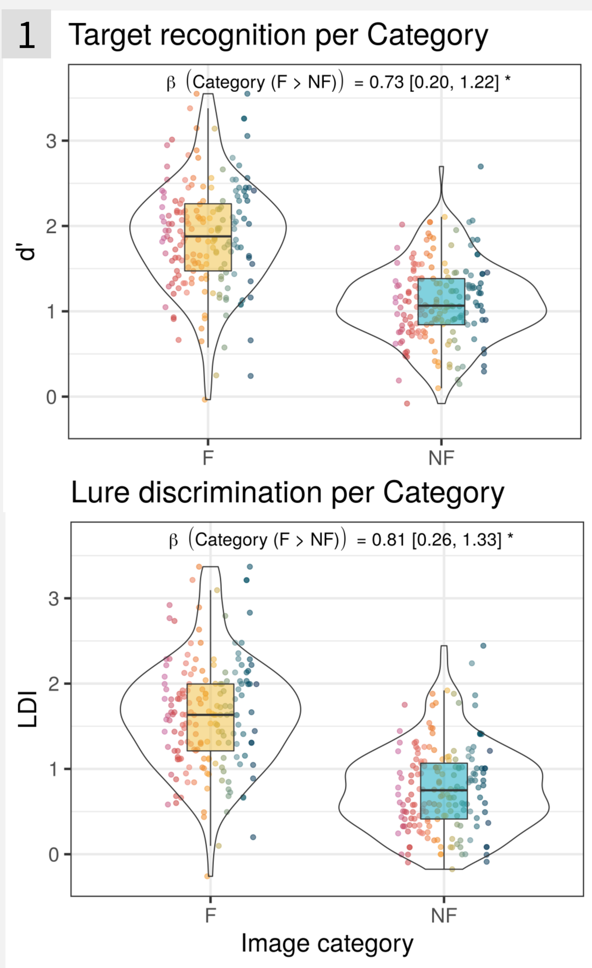


Fig. 1: Visually and statistically higher d' and LDI for food than art images. CI of β does not include 0. Subjects are colour-coded.

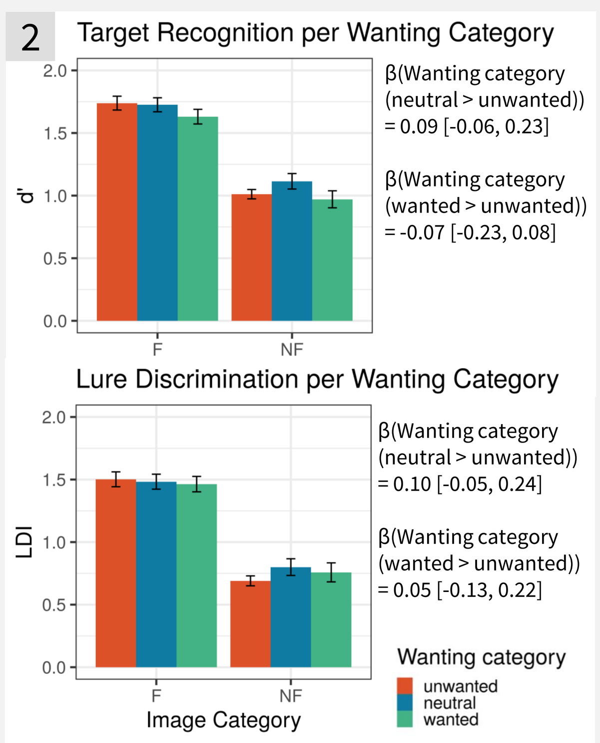


Fig. 2: No evident differences between wanting categories regarding memory performance in any image category.

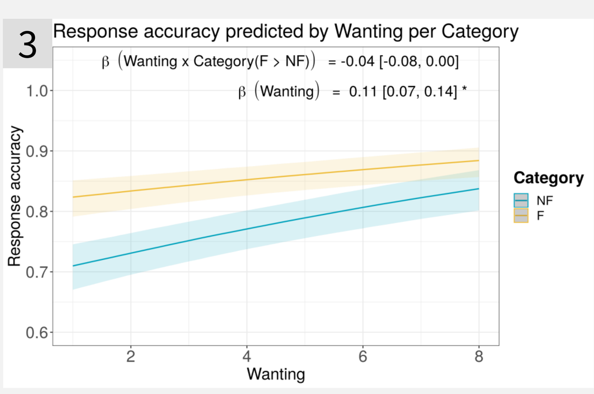


Fig. 3: Food and art response accuracy is evidently predicted by wanting.

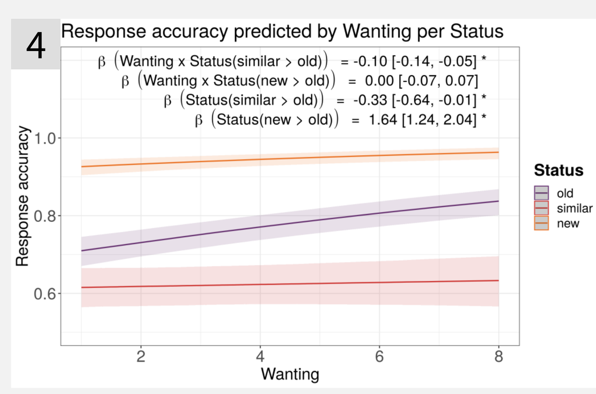


Fig. 4: Influence of wanting on response accuracy is strongest during memory encoding (in old images).

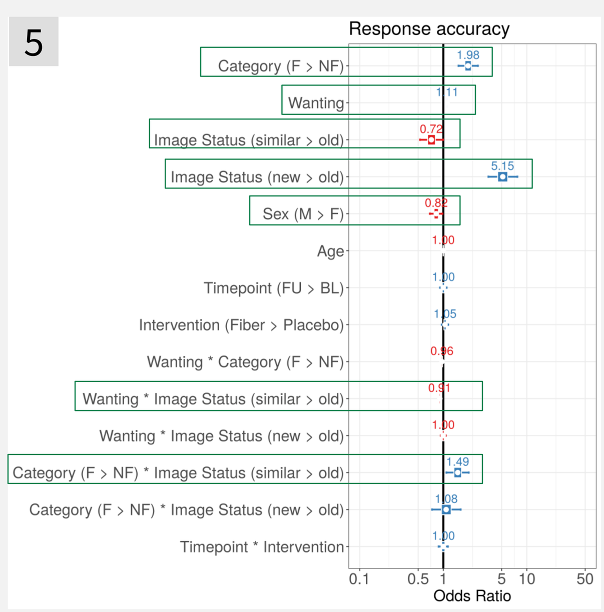


Fig. 5: Effects in behavioural response accuracy full model.

Statistical Analysis:

Bayesian inference testing with Bayesian Multilevel Modeling using Stan with fixed and random effects, e.g.

*d' ~ Image Category + Wanting Category + Image Category * Wanting Category + Age + Sex + Intervention + Timepoint + Intervention * Timepoint + (1 + (Image Category + Wanting Category + Image Category * Wanting Category | Subject) + (Image Category | Set))*

Relevance

obesity epidemic & new insights for cognitive behavioural therapy

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