# Recurrent painful interoceptive sensations of the digestive tract increase general autonomic defensive response activation regardless of picture induced valence

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## (1) Introduction

Interoception = "gut feelings" → emotions / sensations (homeostatic *perception* relies on both)

Emotional modulation of (somatic) pain as well as of dyspnea (both interoceptive) has been demonstrated in earlier research.

Autonomic responses to emotional stimuli have been well described by the emotional priming model by Lang (1995).

However, autonomic responses to aversive interoceptive sensations (as well as to emotional stimuli during such sensations) have not yet been studied as extensively.

Common problem when inducing interoceptive sensations in the lab:

- autonomic responses aimed at restoring homeostasis may occur in addition to autonomic emotional responses ⇨ this complicates interpretation of autonomic responses

Advantage of esophageal stimulation:

- presumably does not induce autonomic responses other than those reflecting emotional state
- can stimulate visceral tissue without involving overlying somatic tissue (strict definition of interoception)

**Research question:**

*Are eye-blink startle and skin conductance during visceral pain modulated by picture induced affective background?*

## (2) Methods

**N = 24 (mean age = 21.5 y/o, 58%♀)**

2 x 3 design:

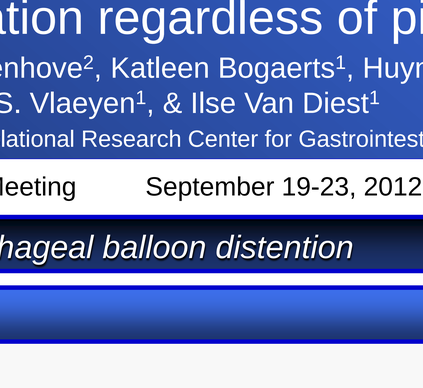
- 2 trial-types: one with occasional distention
  one without any distentions at all
- 3 affective backgrounds (one per trial): positive, neutral and negative valenced pictures

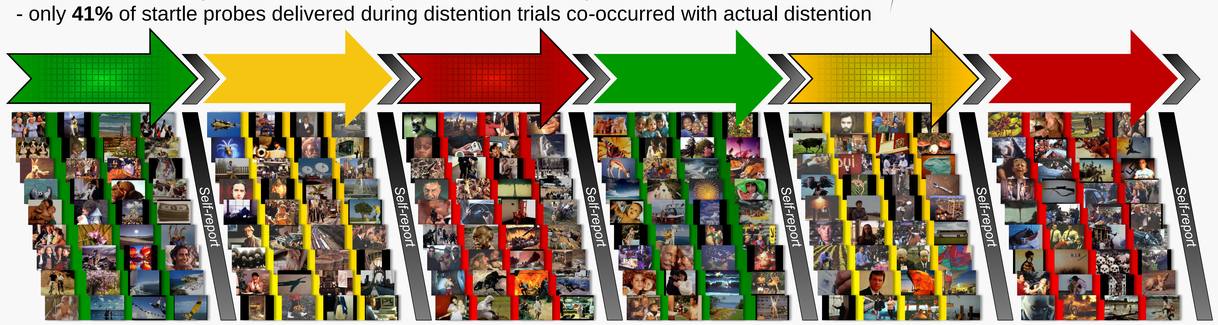
For ALL trials:

- 36 pictures (of same valence) presented per trial
- each picture presented (only once) for 8 seconds, one sec black in between each picture
- 10 startle probes per trial at variable times, but always 4 seconds after picture onset

In trials with a distention:

- individual pain thresholds used for stimulation
- 10 distentions per trial, each distention lasting 5 seconds
- distention onset unpredictable, but always simultaneous with picture onset
- only **41%** of startle probes delivered during distention trials co-occurred with actual distention

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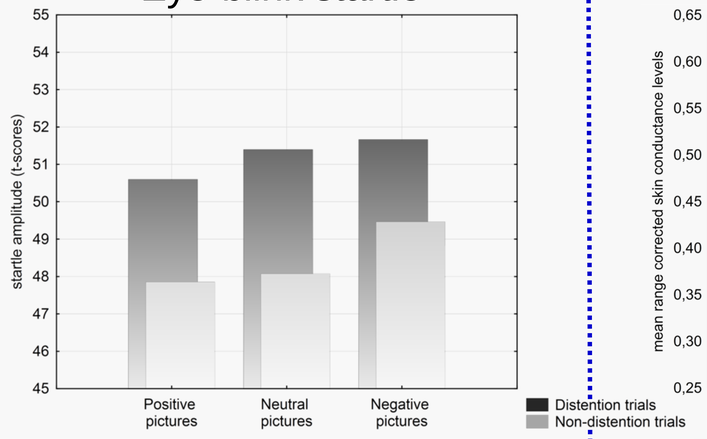
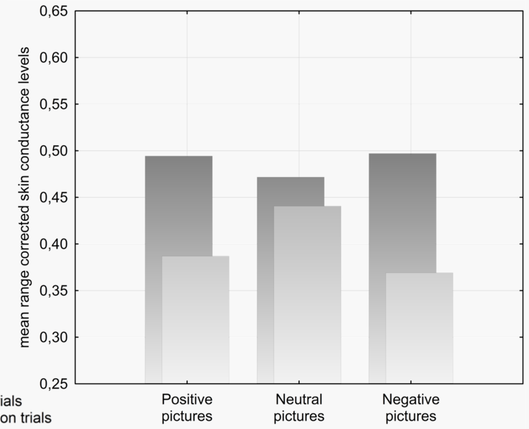
## (3) Results

### Eye-blink startle




- No effect of affective background (picture valence)
- Main effect ($p < 0.001$) for trial type (with versus without distention)
- Main effect of anticipation ($p = .01$)

### Skin Conductance Levels




- Main effect ($p < 0.001$) for trial type (with versus without distention)
- In the non-distention trial, there was a significant effect of affective background on SCL ($p < 0.05$)

Self-report:

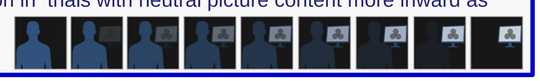
**Valence:** - *main effect for trial type ($p<0.001$), with distention trials being more unpleasant than non-distention trials*
- *main effect for affective background ($p<0.001$), with trials with negative picture content being more unpleasant compared to those with positive content as well as to those with neutral content*

**Arousal:** - main effect for trial type ($p<0.001$), with distention trials being more unpleasant
- main effect for affective background ($p<0.05$), with trials with negative picture content being more arousing than those with positive content. (Negative content was also more arousing than neutral content, but only in non-distention trials)

**Fear:** - *main effect for trial type ($p<0.001$), with distention trials inducing more fear*
- *main effect for affective background ($p<0.001$), with trials with negative picture content inducing more fear than those with positive content and those with neutral content*

**Attention:** - main effect for trial type ($p<0.001$), with attention more 'inwards' in distention trials than in non-distention trials
- main effect for affective background ($p<0.05$), with attention in trials with neutral picture content more inward as compared to trials with positive content.

**Pain:** *there was no affective modulation of pain in the distention trials*



## (4) Discussion

- Higher startles during distention trials (as compared to non-distention trials) reflect the relatively higher unpleasantness and fear experienced during those trials. However, further analysis revealed that startle potentiation during distention trials was mainly due to startle probes delivered during anticipation. (Not so much to probes presented simultaneous with the actual brief distentions.)

- Increased SCLs during distention trials are in accordance with increased self-reported arousal. Higher SCLs found during neutral background during non-distention trials, may be due to increased attention inwards (i.e., to bodily sensations) during a neutral affective background. (Given the invasive nature of the experiment, this might sufficiently increase autonomous arousal).

- Main effects for affective background seen in self-report was not evident in startle nor in skin conductance. This is likely due to the aversiveness and arousal associated with the distention trials, overshadowing effects of affective background in these autonomous responses.

- Likewise, the absence of affective modulation of pain (which is contrary to expectations), may be due to a relative dominance of the aversiveness of the procedure.