Psychophysiological correlates of inquiry and advocacy in human interactions

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Research focus

- Improve structured contexts of organizational behavior and decision making
- Recognize that all behavior involves emotions
- Background:
  - **Organizational learning theory** (Argyris & Schön 1978, Senge 1990): balance inquiry and advocacy
  - **Systems intelligence theory** (Hämäläinen & Saarinen 2004, 2008): positive engagements improve team performance

Inquiry: interested, explorative

- Ask questions, be open, explore and show interest in other's points of view

Advocacy: assertive, narrow

- Assert, be narrow and aggressive, explain own points of view

- Facilitative OR intervention models (Franco & Montibeller 2010)

Inquiry and advocacy in group decision making

- **Theory,** field and behavioral **experiments**
  - Mason (1969), Schweiger, Sandberg & Rechner (1989), Schwenk (1990), Valacich & Schwenk (1995)
- Have shown that **adopting both** inquiry and advocacy modes improve decisions over consensus or expert approaches
  - Higher number of possible solutions
  - Better quality decisions
  - Higher satisfaction with outcomes

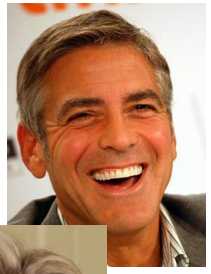
Positive vs. negative emotions in DM research

- Importance of intact somatic processing
- Positive emotions increase cooperativeness, reduce conflict, lead to better outcomes than negative
- Negative emotions create more concessions and reciprocal punishments

- Broaden and build: positive emotions relate to better information processing

Our experiment

- **Emotional correlates** of **inquiry** and **advocacy**
- **Psychophysiological** measurements
  - Emotional **expressions**: Duchenne smile, non-Duchenne smile, furrowed brows
  - Emotional **arousal**: sympathetic ANS activation
  - Empathy questionnaire (control)



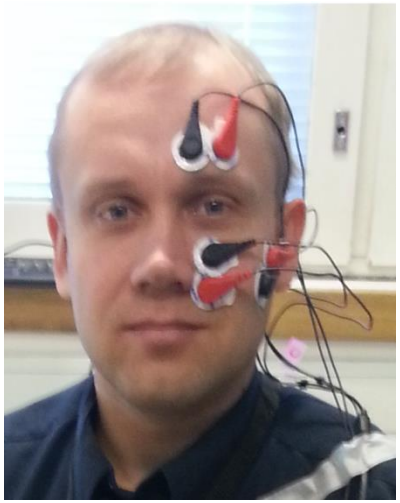
Our hypotheses

- Inquiry elicits **Duchenne smiles**
- Advocacy elicits **furrowed brows**

- **Emotional arousal** level is different (non-directional) between inquiry and advocacy

- **Empathy** is related to a high frequency of expressions and a high level of arousal

Psychophysiological measurements



- Emotional expressions: *electromyography* (**EMG**) from 3 muscle regions on the left hemisphere of face

- Emotional arousal: *skin conductance response* (**SCR**) from left hand fingers

Setup

Inquiry: take an inquisitive approach on the statements of the persons shown on the screen

Advocacy: be critical and if possible, form objections to the statements of the persons shown on the screen

- Dimly lit room
- Comfortable chair
- Stimulus shown on a computer screen

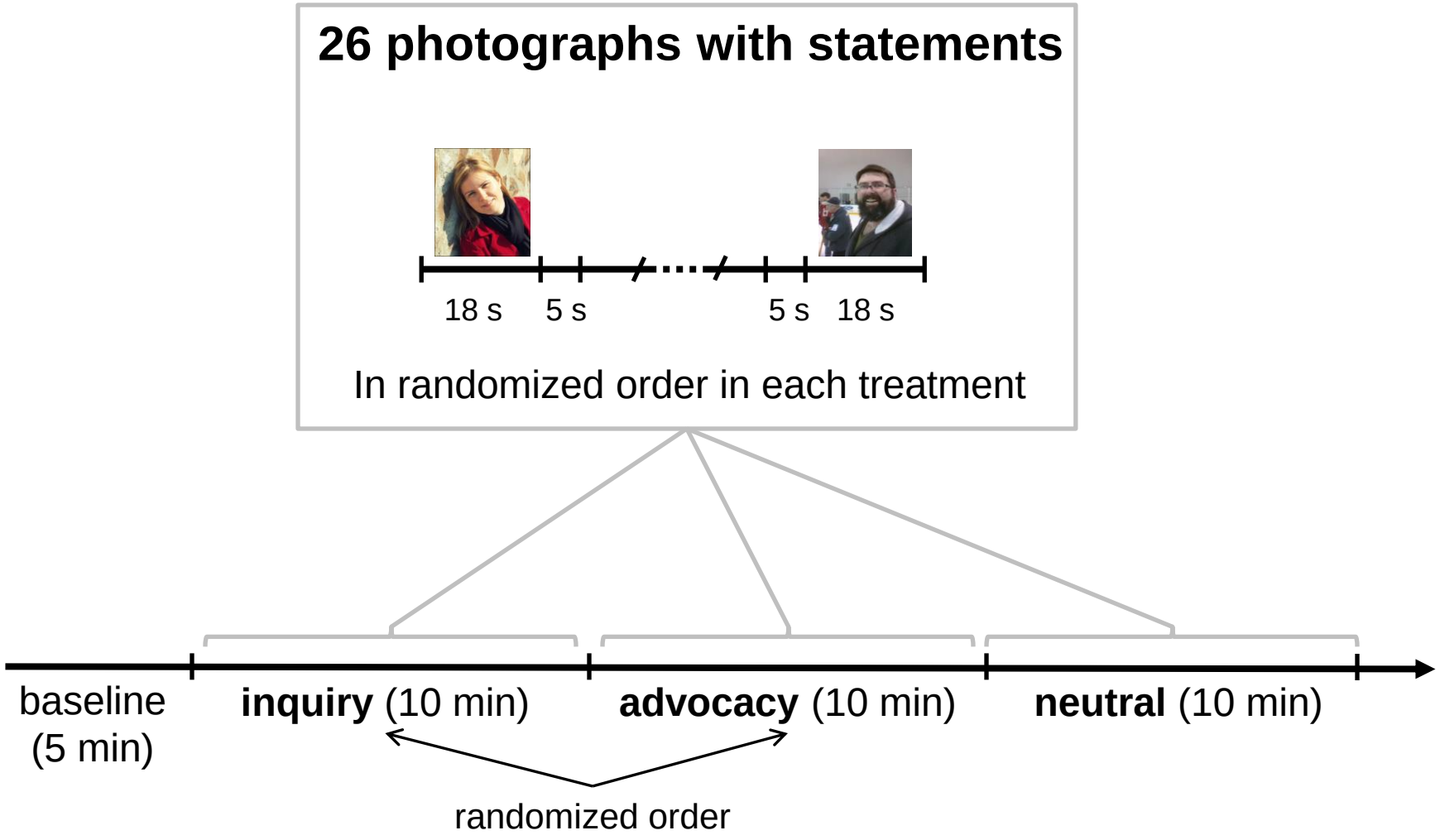
Subjects

- N = 40, M_{age} = 34.6, 22—61 years
- Exclusions from data-analysis:
  - 7 excluded because they failed to understand task (post-experiment questionnaire)
  - 6 excluded from SCR analysis because they did not show the signal
  - Running analysis with all 40 does not dramatically change results

Stimuli and treatments

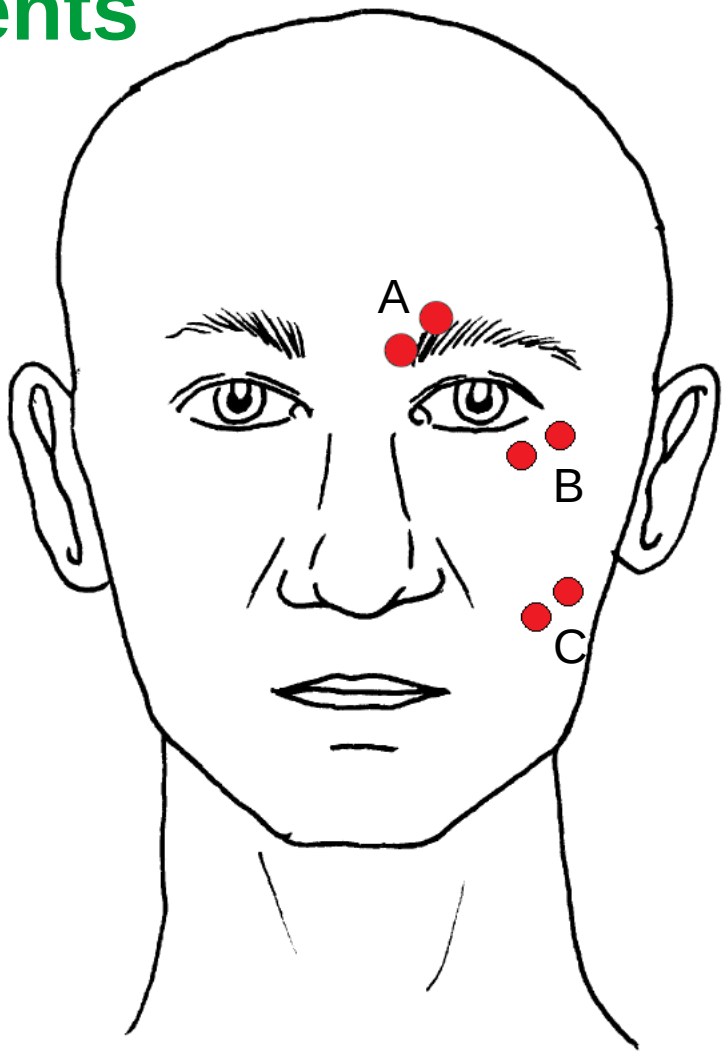
- In each treatment the subjects are shown photographs with statements. This is the stimuli. Tasks:
  - Inquiry: view the stimuli in an inquiry mode (series of 26 stimuli)
  - Break 1 min
  - Advocacy: view the stimuli in an advocacy mode (series of same 26 stimuli)
  - Break 1 min
  - Neutral: view the stimuli in a neutral mode (series of same 26 stimuli)
- Each stimulus shown for 18 s with 5 s breaks in between
- Order of stimuli in the series randomized in each treatment
- Order of inquiry/advocacy randomized for each subject, neutral treatment always last
- Baseline measurement before the treatments, duration 5 min
- Total measurement duration 38 min

Stimuli and treatments

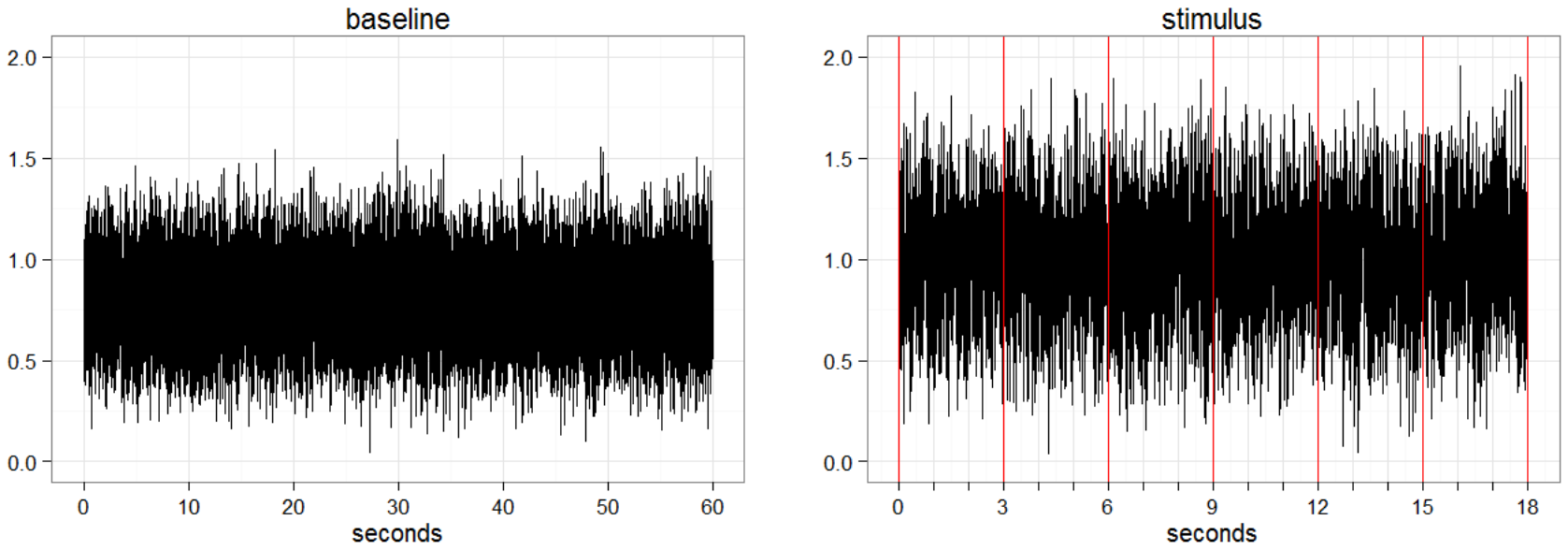


EMG electrode placements

- A: *Corrugator supercilii* – contracts the eyebrow
- B: *Orbicularis oculi* – wrinkles the eye
- C: *Zygomaticus major* – raises the cheek

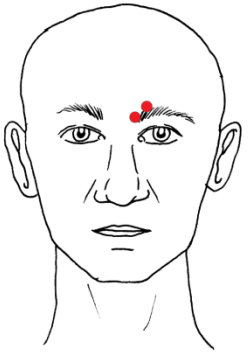


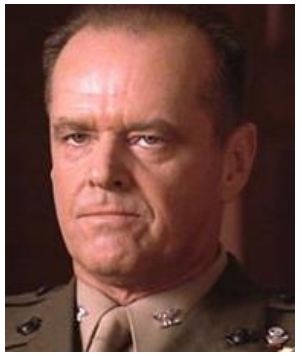
EMG score processing

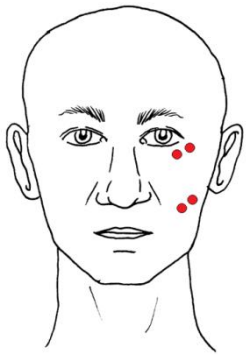


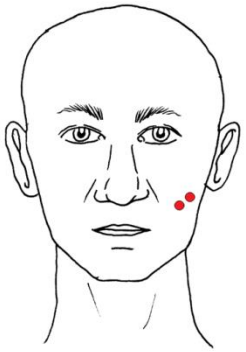
- 2048-Hz signal filtered to 90-200 Hz, smoothed, logarithmized
- Signal during stimulus averaged into 3 s bins
- Bin scored active if bin mean > baseline mean
- **Bin count** = sum of active bins

- Furrowed brow: only *corrugator* active in a bin
- Duchenne smile: *orbicularis* and *zygomaticus* active in a bin
- Non-duchenne: only *zygomaticus* active in a bin









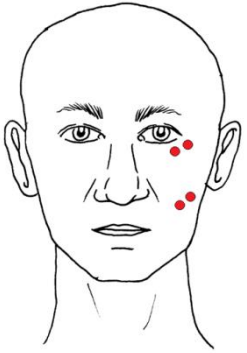
SCR score processing

- SCR has 2 components: tonic and phasic
- Phasic is of interest, corresponds to *sudomotor nerve firing* at ≈ .62 Hz
- 128-Hz signal down-sampled by half and smoothed, deconvoluted to extract the phasic component, integrated in a 17 s window and logarithmized => **ISCR** score
  - Benedek & Kaernbach (2010)
  - www.Ledalab.de (*Matlab* add-on)

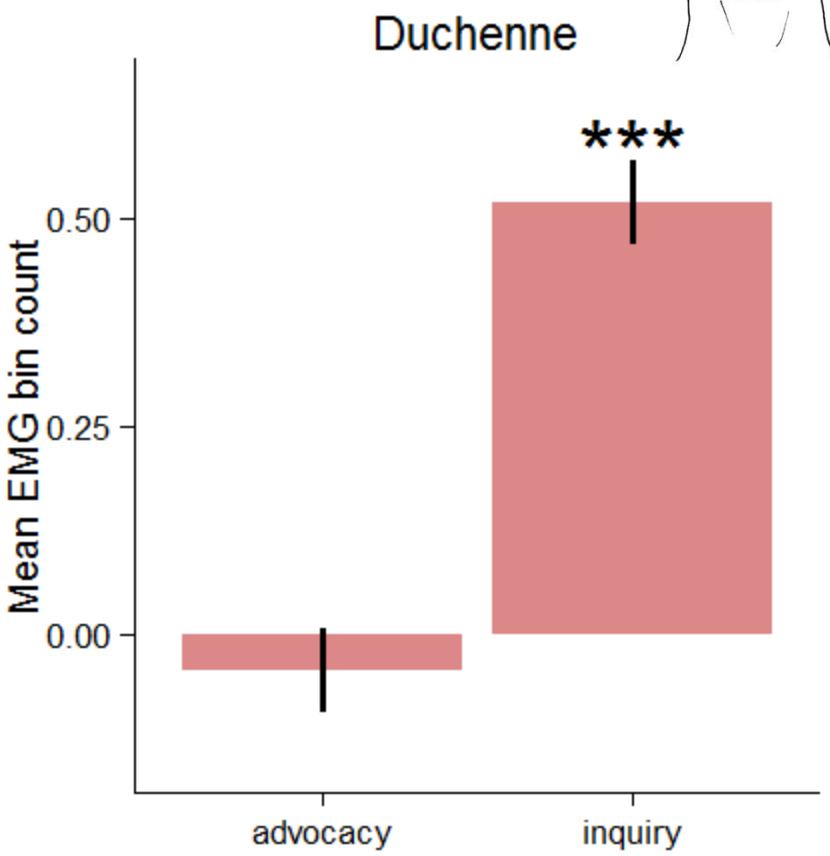
Emotional empathy questionnaire

- Mehrabian & Epstein (1972)
- Empathy: sharing the emotional experience of others
- Before the experiment, 33 item questionnaire
  - "It makes me sad to see a lonely stranger in a group"
  - "Some songs make me happy"
- => Empathy score 0 – 100

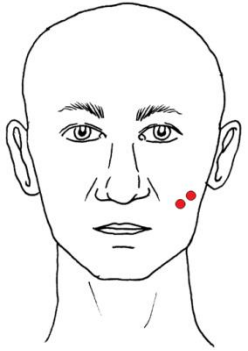
Duchenne smiles in inquiry



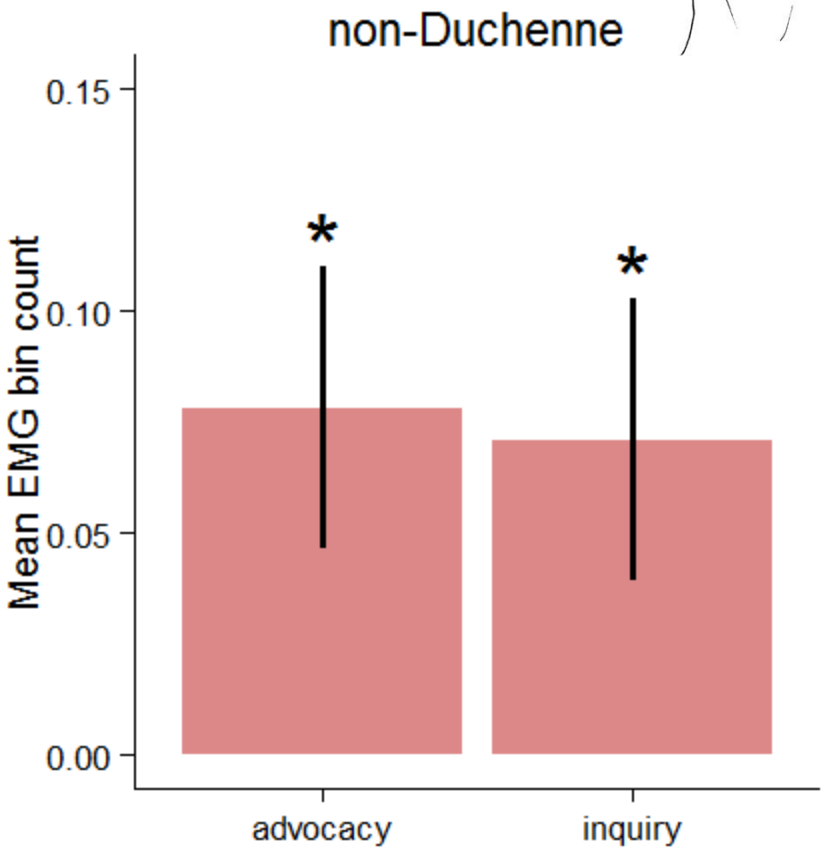
- Linear mixed models (LMM) with subjects as random effects
- Treatments as deviation coded contrasts
- Ref. treatment (neutral) level not shown, moved to zero
- Error bars = SEM



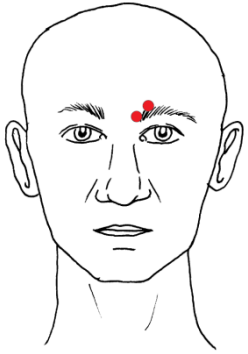
Non-Duchennes in both inquiry and advocacy



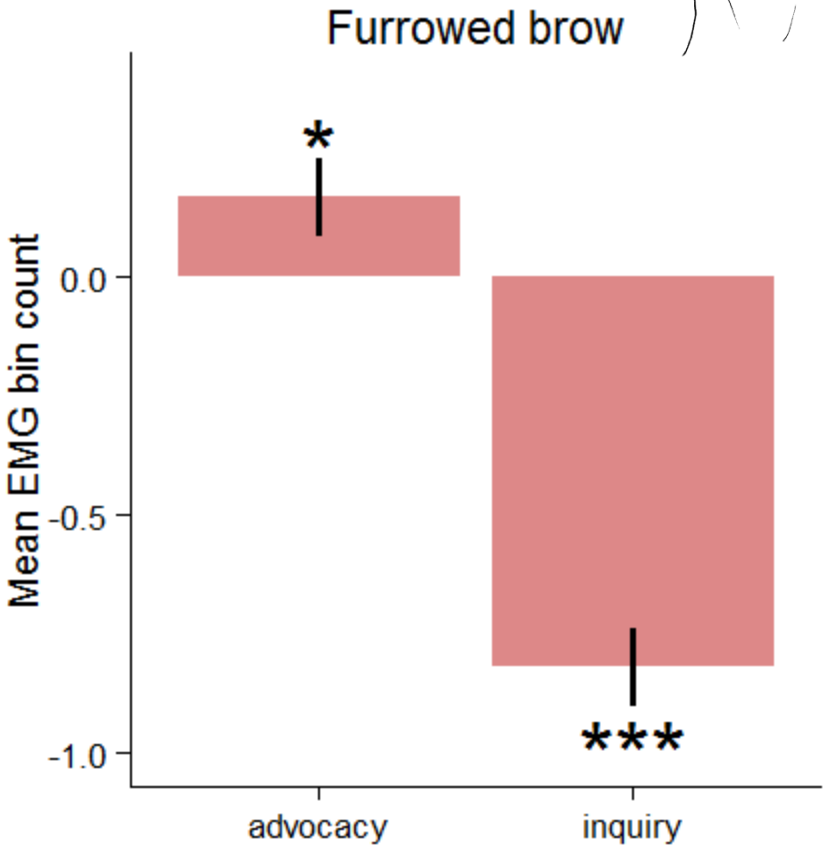
- The difference *between* inquiry and advocacy is not significant (LMM, p = .79)
- => The non-Duchenne smile is not differentially activated in inquiry and advocacy



Furrowed brows show reciprocal effect

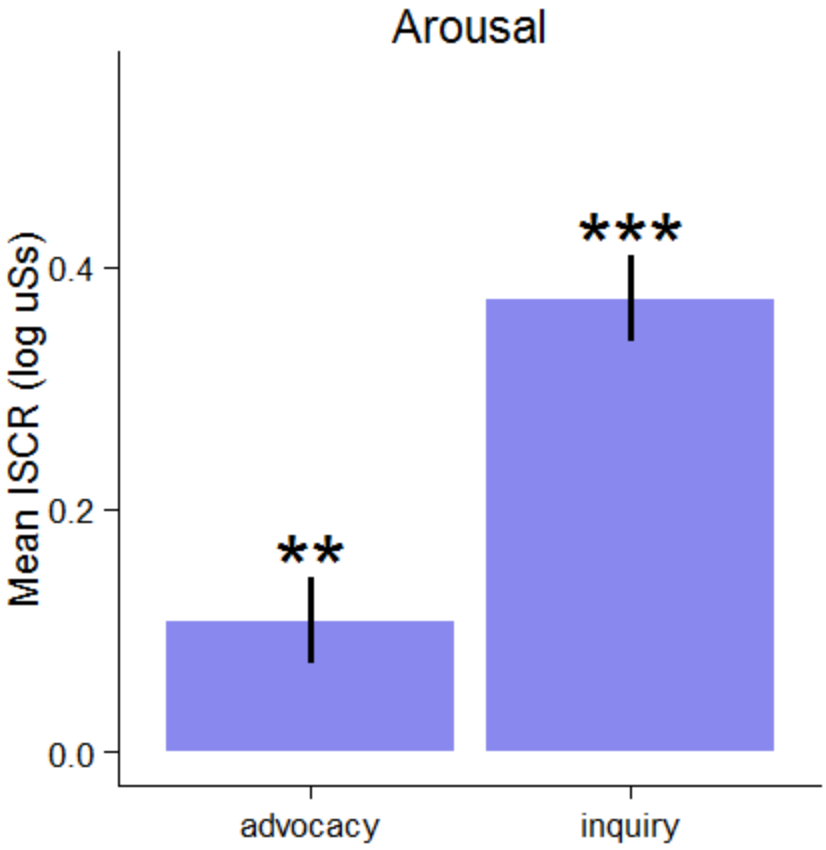


- **More** furrowed brows in advocacy
- **Less** furrowed brows in inquiry
- This is a known pattern of *corrugator* activation (Larsen et al. 2003)



Arousal in both inquiry and advocacy

- Arousal is significantly higher in inquiry than in advocacy (LMM, $p < .0001$)
- Additional hypothesis: is arousal only related to the *smiles*?



Arousal as function of the expressions: treatment effects

- Duchennes: constant and increasing relationship in all treatments
- non-Duchennes: treatment interaction effect
  - Arousal increased in the bin count of non-Duchenne smiles in inquiry, but decreased in the bin count of non-Duchenne smiles in advocacy
- Furrowed brows: no relationship

- The Duchenne smile is possibly the only genuine internal emotional state

Empathy vs. emotional measures

- Mean empathy score 43.4 (SD 23.7)
- Across treatments:
  - Only relates to non-Duchenne smiles; the higher the empathy score, the more there were non-Duchenne smiles in all treatments

- May imply: non-Duchennes are volitional and reflect the subject's empathic tendency

Summary

- Study the psychophysiological correlates of **inquiry** and **advocacy** modes of interaction
- Inquiry elicits **positive emotions** (Duchenne smiles) and advocacy elicits **negative emotions** (furrowed brows)
- **Emotional arousal** is higher in inquiry than in advocacy and related to positive emotions
- **Empathy** increases frequency of non-genuine positive emotions

Future research

- Better external validity with an actual group decision making situation
- Psychophysiological correlates of inquiry and advocacy in other behavioral experiments
  - Interactive situations and strategic decision making
  - Individual decision making
  - Trust and cooperation in repeated interactions
  - Role of empathy?

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