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:
  – **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**

- 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

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

**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
Subjects

- $N = 40$, $M_{\text{age}} = 34.6$, 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

26 photographs with statements

18 s  5 s  5 s  18 s

In randomized order in each treatment

baseline (5 min)  inquiry (10 min)  advocacy (10 min)  neutral (10 min)

randomized order
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)
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, \( p = 0.79 \))

• => 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?
References


